

# **An Examination of the Hadley Sea-Surface Temperature Time Series for the Niño 3.4 Region**

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National Aeronautics and  
Space Administration

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## TABLE OF CONTENTS

1. INTRODUCTION .....	1
2. RESULTS AND DISCUSSION .....	3
2.1 Annual Averages of HadSST in the Niño 3.4 Region (1871–2008) .....	3
2.2 Monthly and 12-mma Values of HadSST in the Niño 3.4 Region (1871–2008) .....	6
2.3 2-mma Values of Seasonally Adjusted Monthly Means of HadSST (D(m2)) and SOI (SOI(2)) in the Niño 3.4 Region (1871–2008) .....	27
2.4 The ONI Values in the Niño 3.4 Region (1950–2008) .....	33
2.5 The Duration-Maximum Anomaly Association for ENSO Extreme Events .....	34
2.6 Recurrence Periods of the ENSO Extremes .....	35
2.7 Decadal Aspects of ENSO Extremes .....	38
3. SUMMARY .....	40
APPENDIX .....	43
REFERENCES .....	81

## LIST OF FIGURES

1.	Annual and 10-yma values of (a) mean and (b) high values of HadSST in the Niño 3.4 region from 1871 to 2008 .....	4
2.	Annual and 10-yma values of (a) low values and (b) differences (high minus low) of HadSST in the Niño 3.4 region from 1871 to 2008 .....	5
3.	Annual and 10-yma values of January values of HadSST in the Niño 3.4 region from 1871 to 2009 .....	11
4.	Annual and 10-yma values of February values of HadSST in the Niño 3.4 region from 1871 to 2009 .....	12
5.	Annual and 10-yma values of March values of HadSST in the Niño 3.4 region from 1871 to 2008 .....	13
6.	Annual and 10-yma values of April values of HadSST in the Niño 3.4 region from 1871 to 2008 .....	14
7.	Annual and 10-yma values of May values of HadSST in the Niño 3.4 region from 1871 to 2008 .....	15
8.	Annual and 10-yma values of June values of HadSST in the Niño 3.4 region from 1871 to 2008 .....	16
9.	Annual and 10-yma values of July values of HadSST in the Niño 3.4 region from 1871 to 2008 .....	17
10.	Annual and 10-yma values of August values of HadSST in the Niño 3.4 region from 1871 to 2008 .....	18
11.	Annual and 10-yma values of September values of HadSST in the Niño 3.4 region from 1871 to 2008 .....	19
12.	Annual and 10-yma values of October values of HadSST in the Niño 3.4 region from 1871 to 2008 .....	20
13.	Annual and 10-yma values of November values of HadSST in the Niño 3.4 region from 1871 to 2008 .....	21

## LIST OF FIGURES (Continued)

14.	Annual and 10-yma values of December values of HadSST in the Niño 3.4 region from 1871 to 2008 .....	22
15.	Monthly and 12-mma values of nonseasonally adjusted HadSST values from January 1871 to January 2010 .....	27
16.	Monthly and 2-mma values of the seasonally adjusted values of HadSST anomaly (D(m2)) from February 1871 to January 2010, where shaded portions reflect occurrences of warm EN events (positive anomalies) and cold LN events (negative anomalies), respectively .....	27
17.	Presentation of 2-mma values of SOI (SOI(2)) anomaly from January 1871 to January 2010 .....	30
18.	Results of epoch analysis for EN events, (a) D(m2) and (b) SOI(2) .....	31
19.	Results of epoch analysis for LN events, (a) D(m2) and (b) SOI(2) .....	32
20.	The ONI anomalies from January 1950 to January 2010, where shaded portions reflect occurrences of warm EN events (positive anomalies) and cold LN events (negative anomalies), respectively .....	33
21.	Duration against (a) max ONI for LN and EN events (1950 – 2008) and (b) max D(m2) for LN and EN events (1871 – 2008) .....	36
22.	RP-duration distributions for (a) EN events (1950–2008) based on D(m2), (b) LN events (1950–2008) based on D(m2), (c) EN events (2000–2009) based on ONI, and (d) LN events (2000–2009) based on ONI .....	37
23.	RP-duration distribution for (a) EN events (1871–2008) based on D(m2) and (b) LN events (1871–2008) based on D(m2) .....	37
24.	Decadal variation of (a) NENO, (b) NENM, (c) NLNO, and (d) NLNM based on D(m2). The 2009 EN event observed in ONI has been included with the 2000–2009 decade, even though HadSST values have not yet been published .....	39

## LIST OF TABLES

1.	Annual and 10-yma values of SST in the Niño 3.4 region based on HadSST monthly time series from 1871 to 2008 .....	7
2.	Frequency of occurrence of monthly high and low values of SST in the Niño 3.4 region based on HadSST values from 1871 to 2008 .....	10
3.	HadSST monthly and 10-yma values for the Niño 3.4 region from 1871 to April 2009 .....	23
4.	Listing of EN and LN events based on the HadSST dataset from 1871 to 2008 .....	28
5.	Frequency of occurrence of start, peak, and end times for HadSST-determined EN and LN events .....	30
6.	Listing of EN and LN events based on ONI (ERSST.v3b) .....	34
7.	SST monthly values of the Niño 3.4 region in degrees Celsius based on HadSST time series, ONI and SOI values, and the occurrences of EN (warm) and LN (cold) events from 1871 to the present .....	44



## LIST OF ACRONYMS AND ABBREVIATIONS

2-mma	2-month moving average
12-mma	12-month moving average
10-yma	10-year moving average
D(m)	difference between Hadley sea-surface temperature and the monthly-adjusted average (1871–2008)
D(m2)	2-mma of D(m)
DP	double peak
e	event end, based on Oceanic Niño Index
EN	El Niño
ENSO	El Niño Southern Oscillation
ERSST.v3b	Extended Reconstructed Sea-Surface Temperature, version 3b
HadSST	Hadley sea-surface temperature
H(M)	high (month)
L(M)	low (month)
LN	La Niña
M	moderate
MP	multiple peaks
NENM	number of EN months
NENO	number of EN onsets
NLNM	number of La Niña months
NLNO	number of La Niña onsets

## **LIST OF ACRONYMS AND ABBREVIATIONS (Continued)**

ONI	Oceanic Niño Index
p	peak
RP	recurrence period
S	strong
s	event start, based on the Oceanic Niño Index
SOI	Southern Oscillation Index
SOI(2)	2-mma of Southern Oscillation Index
SP	single peak
SST	sea-surface temperature
VS	very strong
W	weak

## NOMENCLATURE

<i>cl</i>	confidence level
<i>CV</i>	coefficient of variation
<i>na</i>	number above median
<i>nb</i>	number below median
<i>nra</i>	number of runs above median
<i>PCS</i>	Pearson Coefficient of Skewness
<i>PI</i>	prediction interval
<i>r</i>	coefficient of correlation
<i>r<sup>2</sup></i>	coefficient of determination
<i>sd</i>	standard deviation
<i>se</i>	standard error of estimate
<i>x</i>	independent variable in regression equation
<i>y</i>	dependent variable in regression equation
<i>z</i>	normal deviate for the sample



## TECHNICAL PUBLICATION

### AN EXAMINATION OF THE HADLEY SEA-SURFACE TEMPERATURE TIME SERIES FOR THE NIÑO 3.4 REGION

#### 1. INTRODUCTION

The El Niño (EN) southern oscillation (ENSO) phenomenon has been described as the strongest oceanic-atmospheric tropical signal measured on interannual timescales.<sup>1–3</sup> Although primarily perceived as a tropical Pacific event, as evinced by its strongly coupled sea-surface temperature (SST) and atmospheric pressure variations, the effects of ENSO impact Earth on a global scale.<sup>1,2,4–10</sup>

El Niño and La Niña (LN), respectively, refer to the anomalous episodic warm and cold water phases of the ENSO variation, when based upon SST, and to the anomalous negative and positive atmospheric pressure phases, respectively, when based on the Southern Oscillation Index (SOI).<sup>11,12</sup> During an EN event, the westerly trade winds along the Earth's equator weaken as atmospheric pressure rises in the western Pacific (Darwin, Australia) and falls in the eastern Pacific (Tahiti, French Polynesia). As a consequence of this action (called the Bjerknes feedback mechanism<sup>13</sup>), anomalous warming in the central and eastern Pacific occurs due to eastward migrating warm water from the western Pacific, which diminishes the strong cold-water upwelling off the South American coast.<sup>14,15</sup> The reverse happens during an LN event (i.e., enhanced upwelling, positive SOI, and anomalous cooling in the eastern Pacific). When neither an EN nor a LN event is said to be occurring, conditions are more generally described as being ENSO neutral.

While the occurrences of EN events have been traced back hundreds of years, as gleaned from reports of anomalous rainfalls and storm events on coastal Peru, ship records, etc.,<sup>16–18</sup> more recently, the use of SST, in particular those SST readings from the Niño 3.4 region (5° N.–5° S., 120–170° W.) have provided the most reliable means for documenting the onsets, strengths, and durations of both EN and LN events. In fact, now, published monthly is the Oceanic Niño Index (ONI), a 2-month moving average (2-mma; also called the 3-month running mean) of the Extended Reconstructed SST, version 3b (ERSST.v3b) anomalies of the Niño 3.4 region, which provides an easily accessible means for monitoring the onsets, strengths, and durations of both EN and LN events, particular, from 1950 onwards.<sup>19,20</sup>

On the basis of the ONI, an EN event is said to be occurring when the index value measures 0.5 °C or warmer for at least 5 continuous months. An EN event is termed “weak (W)” when the peak positive warm anomaly measures 0.5–0.9 °C, “moderate (M)” when the peak positive warm anomaly measures 1.0–1.4 °C, and “strong (S)” when the peak positive warm anomaly measures 1.5 °C or warmer. Similarly, an LN event is said to be occurring when the ONI measures –0.5 °C or cooler for at least 5 continuous months. A LN event is termed W when the peak negative cool

anomaly measures  $-0.5$  to  $-0.9$  °C, M when the peak negative cool anomaly measures  $-1.0$  to  $-1.4$  °C, and S when the peak negative cool anomaly measures  $-1.5$  °C or cooler.

Previously, the decadal variation of EN events was examined using the ONI-determined listing of EN events (1950–2008) to investigate whether it could possibly be related to global warming or more simply be a manifestation of natural variation.<sup>21,22</sup> From that study, it was found that the decadal variation of the number of EN onsets was better explained as one expressing normal fluctuation rather than one related to global warming. Surprisingly, it was also inferred that, for M and S events, a statistically significant linear relationship (at the 2% level of statistical significance) was found to exist between the onset of the next EN event (the recurrence period (RP)) and the last known duration of an EN event, strongly suggesting that another EN event likely would have its onset in 2009, which turned out to be true. Because EN, indeed, recurred during 2009, a sharp reduction in the frequency of North Atlantic basin tropical cyclones during the 2009 hurricane season should have been expected and, indeed, was seen, with respect to earlier forecasts for the North Atlantic basin hurricane season.<sup>23–25</sup>

In this study, the HadSST dataset for the Niño 3.4 region is examined to determine the onsets, strengths, and durations of EN and LN events during the interval 1871–2008.<sup>26,27</sup> Also, comparison is made against both SOI values for the same time interval and the ONI-determined listing of ENSO extremes since 1950 to see what differences might possibly exist,<sup>28</sup> if any, especially with regard to the identification of the occurrence, strength, and duration of ENSO extremes. Additionally, the duration-maximum anomaly association for ENSO extremes and the RP-duration association, previously found for EN events using ONI, are investigated to determine if they also might exist using the HadSST dataset. Finally, decadal aspects of the ENSO extremes are examined, anticipating what possibly might lie ahead for the current decade (2010–2019).

## 2. RESULTS AND DISCUSSION

### 2.1 Annual Averages of HadSST in the Niño 3.4 Region (1871–2008)

Figure 1 displays (a) the annual mean and (b) annual high HadSST values in degrees Celsius for the interval 1871–2008 (shown as the thin jagged lines) and their 10-yr moving average (10-yma) values (shown as the thick smoothed lines). Figure 2 similarly shows (a) the annual low and (b) the annual difference (high minus low HadSST values) in degrees Celsius for the same time interval. For each temperature, the mean for the entire interval is plotted as the horizontal line: 26.95 °C for the annual means, 27.87 °C for the annual highs, 25.92 °C for the annual lows, and 1.97 °C for the annual differences. Also, for each panel, given are the standard deviation (*sd*), the coefficient of variation ( $CV = sd/\text{mean}$ ), the median, the Pearson coefficient of skewness ( $PCS = 3(\text{mean} - \text{median})/sd$ ), the number of annual values above the median (*na*), the number of annual values below the median (*nb*), the number of runs above the median (*nra*), the normal deviate for the sample results to determine whether the distributions are randomly distributed ( $z = (nra - na(nb + 1)/(na + nb))/((na(nb + 1)(na - 1)/(na + nb)^2)(nb(na + nb - 1)))^{1/2}$ ), the highest and lowest annual value and their occurrence years, the 50% prediction interval (50% PI), the inferred regression equation based on linear regression analysis against time (*y*), the coefficient of correlation (*r*), the coefficient of determination ( $r^2$ , a measure of the amount of variance explained by the inferred regression), the standard error of estimate (*se*), and the confidence level (*cl*) of the inferred regression, except for the annual lows since the inferred regression and the mean were essentially the same.

For the annual means (fig. 1a), one finds its highest value to have occurred in 1877, measuring 28.30 °C, and its lowest value to have occurred in 1890, measuring 25.78 °C. Runs testing indicates that the distribution of yearly means is nonrandomly distributed ( $z = -2.38$ ). The inferred regression suggests a slight warming with time (about 0.00154 °C per yr), although the inferred regression is only of marginal statistical significance ( $cl > 90\%$ ), suggesting that the inferred regression probably can be disregarded. In fact, the inferred long-term warming disappears if one neglects the earliest portion of the data (i.e., that part prior to about 1895). The nonrandom nature of the distribution of annual means may simply be a reflection of its decadal variation (represented by the thick smoothed line). The decadal variation is strikingly upward from about 1950 to 1995, increasing from 26.68 °C in 1951 to 27.28 °C in 1994, with large peaks in 1962 and 1982, a large dip in 1971, and a shallow dip in 1985. Since 1994, the trend in decadal values has been downward, falling below the long-term mean in 2003. About 25% of the time, the annual mean is found to exceed 27.34 °C, and about 25% of the time it falls below 26.56 °C.

For both the annual high (fig. 1b) and low values (fig. 2a), one finds similar episodic behavior (i.e., based on the 10-yma values) akin to that of the annual means, although the behavior demonstrated by the lows seems strikingly more pronounced. While the annual highs appear to be randomly distributed, the lows, in contrast, appear to be nonrandomly distributed (like the annual means). Neither the annual highs nor lows have statistically significant inferred upward linear regressions against time. For the highs, the highest high occurred in 1878, measuring 29.19 °C, and the lowest

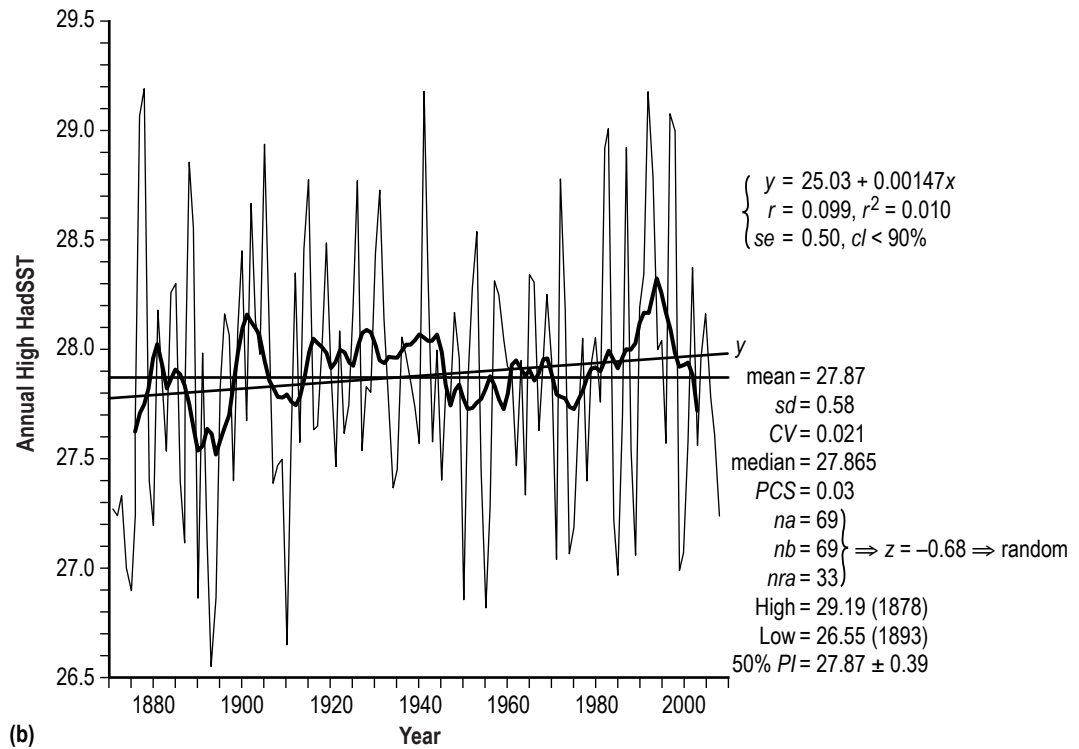
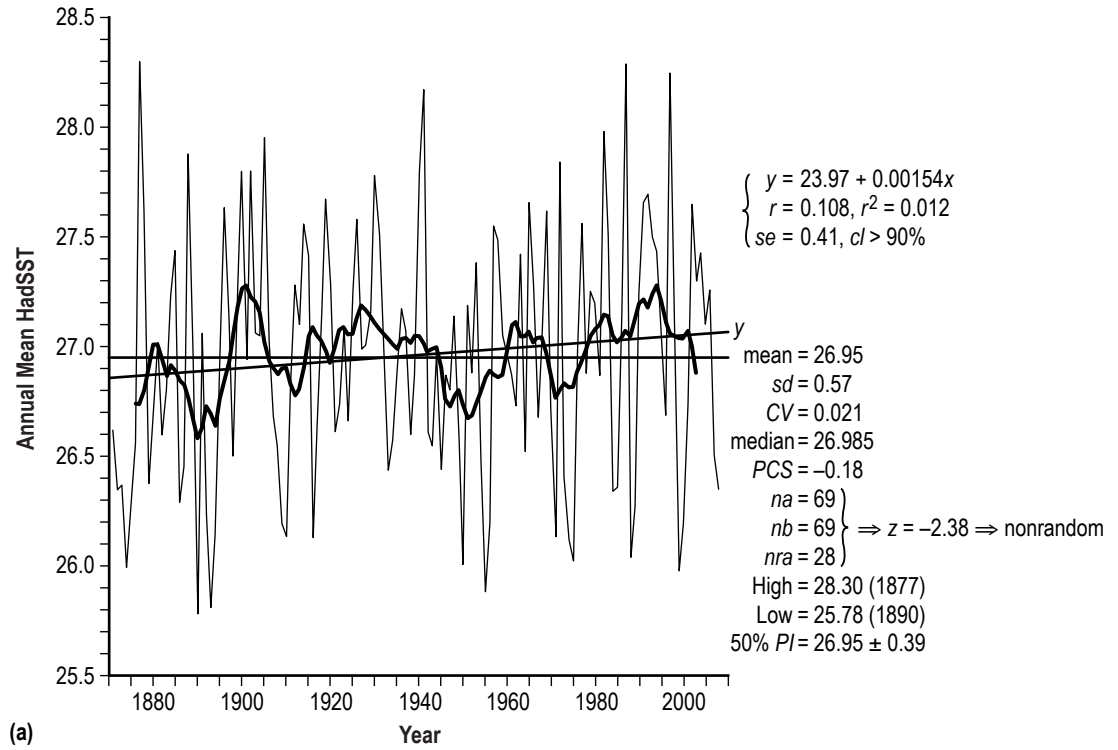


Figure 1. Annual and 10-yma values of (a) mean and (b) high values of HadSST in the Niño 3.4 region from 1871 to 2008.



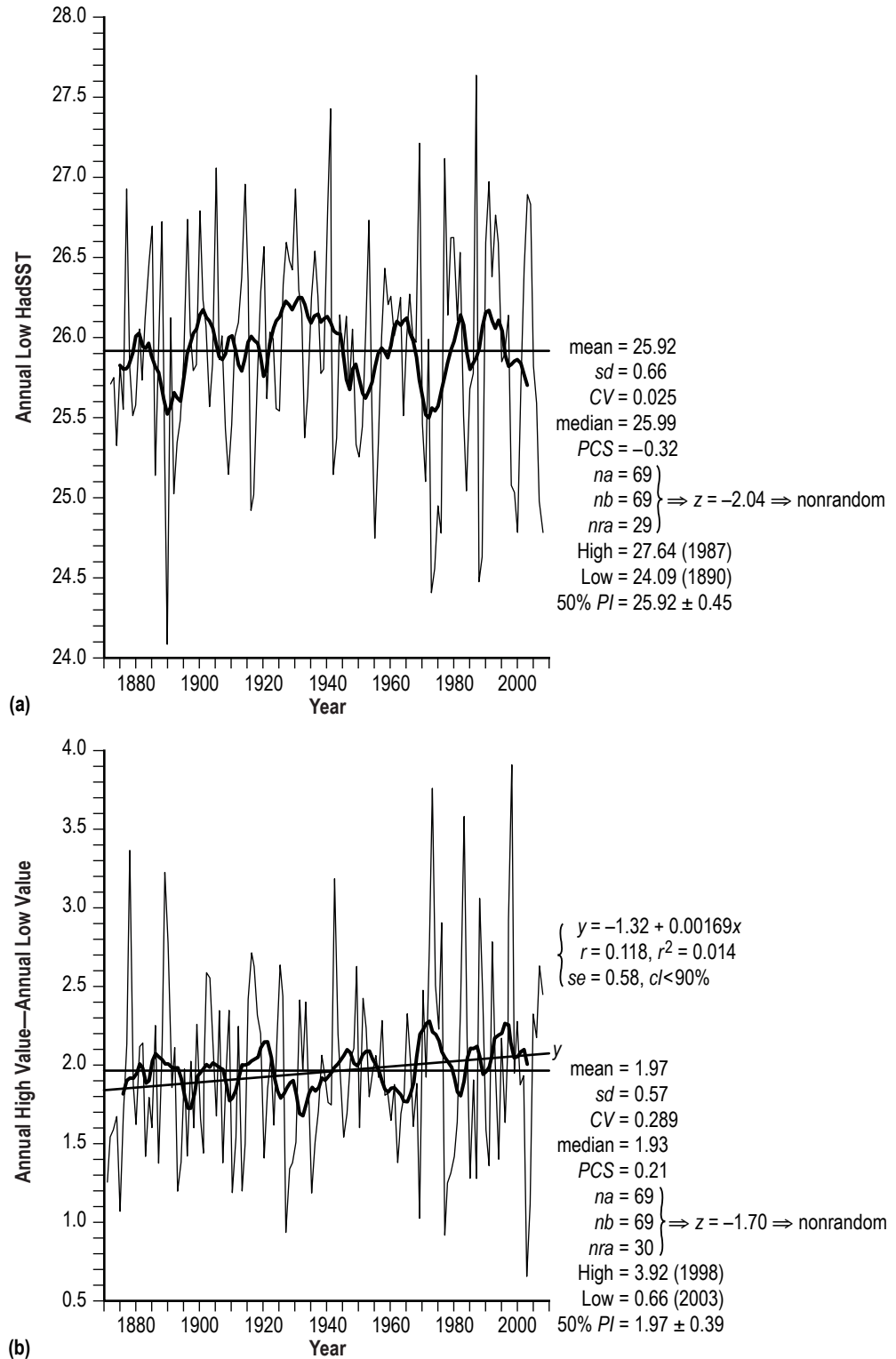


Figure 2. Annual and 10-yma values of (a) low values and (b) differences (high minus low) of HadSST in the Niño 3.4 region from 1871 to 2008.

high occurred in 1893, measuring 26.55 °C. For the lows, the highest low occurred in 1987, measuring 27.64 °C, and the lowest low occurred in 1890, measuring 24.09 °C. The 10-yma values for both the annual highs and lows have recently fallen to values below their respective long-term means.

Figure 2b plots the annual difference between the high minus low values. The annual differences appear to be nonrandomly distributed, with the highest difference occurring in 1998, measuring 3.92 °C, and the lowest difference occurring in 2003, measuring 0.66 °C. The inferred regression is not statistically important. The 10-yma values of the differences currently remain above its long-term mean, although they appear to be decreasing with time and may soon fall below its long-term mean.

For convenience, table 1 is included, which provides a listing of the annual means, highs, lows, and differences, as well as their 10-yma values and statistical aspects for each year and each grouping of SST values. Additionally, the listing identifies the month within each year when the extremes (lows and highs) occurred. Table 2 gives the frequency distribution of the monthly occurrences of the extremes. One finds that more than 80% of the time, the highest yearly value occurs in the months of April, May, and June, while, more than 80% of the time, the lowest yearly value occurs in the months of November, December, and January. Obviously, a strong seasonal effect exists within the HadSST data that must be removed if one seeks to correctly describe the occurrences, strengths, and durations of EN and LN events (i.e., any anomalies that might be embedded in the time series).

Figures 3–14 display individually the monthly values, January thru December, for the 138-yr history of HadSST measurements (1871–2008). The plots are constructed similar to figures 1 and 2, giving each year's monthly value as the thin jagged line and the 10-yma as the thick smoothed line, with the statistics identified for each month given to the right. Five months display nonrandom variations, including January, March, April, June, and July, with the remainder displaying random variations. Table 3 summarizes the mean and 10-yma values for each month, as well as giving various statistics for each month.

## **2.2 Monthly and 12-mma Values of HadSST in the Niño 3.4 Region (1871–2008)**

Figure 15 displays the nonseasonally adjusted monthly means of HadSST for 1871–2008.<sup>27</sup> The thin jagged line is the monthly mean and the thick smoothed line is the 12-mma value. The horizontal line is the mean for the entire interval (1871–2008). Clearly, the variation of the 12-mma values of HadSST is episodic, displaying values both lower and higher than the long-term mean. Cooler 12-mma values of HadSST suggest the occurrences of LN-like conditions, while warmer 12-mma values of HadSST suggest the occurrences of EN-like conditions. Since about mid 2007, the 12-mma values of HadSST have been cooler than the long-term mean, reflecting LN-like conditions, although the current trend has been upward towards warmer values (since December 2007). EN-like conditions seemed certain to prevail in the latter half of 2009 (HadSST monthly values have been published only thru April 2009, meaning that 12-mma values of HadSST can only be computed up thru October 2008). In fact, based on ONI, EN-like conditions, indeed, first appeared in June 2009 and have continued through the end of the year, indicating the occurrence of an EN event, one that had been predicted in the earlier study.<sup>21</sup> (ONI = 1.8 °C in December 2009, a value indicative of an S EN event.)

Table 1. Annual and 10-yma values of SST in the Niño 3.4 region based on HadSST monthly time series from 1871 to 2008.

Year	Mean SST	10-yma	sd	L(M)	10-yma	H(M)	10-yma	H(M)-L(M)	10-yma	Median	CV	PCS
1871	26.61	–	0.41	26.01(12)	–	27.27(04)	–	1.26	–	26.525	0.015	0.62
1872	26.35	–	0.61	25.71(12)	–	27.25(05)	–	1.54	–	26.08	0.023	1.33
1873	26.37	–	0.59	25.75(02)	–	27.33(05)	–	1.58	–	26.185	0.022	0.94
1874	25.99	–	0.61	25.33(11)	–	27.00(05)	–	1.67	–	25.76	0.023	1.13
1875	26.29	–	0.43	25.83(12)	–	26.90(05)	–	1.07	–	26.215	0.016	0.52
1876	26.56	26.74	0.52	25.56(02)	25.81	27.25(06)	27.63	1.69	1.82	26.755	0.020	–1.13
1877	28.30	26.74	0.65	26.93(01)	25.81	29.07(12)	27.71	2.14	1.90	28.56	0.023	–1.20
1878	27.62	26.80	1.30	25.83(12)	25.83	29.19(02)	27.75	3.36	1.92	28.025	0.047	–0.93
1879	26.38	26.89	0.64	25.52(11)	25.91	27.40(04)	27.82	1.88	1.92	26.32	0.024	0.28
1880	26.69	27.01	0.47	25.58(01)	26.01	27.20(04)	27.96	1.62	1.95	26.745	0.018	–0.35
1881	27.02	27.05M	0.74	26.06(11)	26.03M	28.18(04)	28.03M	2.12	2.00M	26.895	0.027	0.51
1882	26.60	26.94	0.73	25.74(11)	25.95	27.88(05)	27.94	2.14	1.99	26.395	0.027	0.84
1883	26.80	26.87m	0.52	26.12(01)	25.94m	27.54(04)	27.83m	1.42	1.89m	26.715	0.019	–0.66
1884	27.23	26.91M	0.52	26.47(01)	25.97M	28.26(05)	27.87	1.79	1.90	27.05	0.019	1.04
1885	27.44	26.89	0.41	26.70(01)	25.89	28.30(05)	27.91M	1.60	2.03	27.415	0.015	0.18
1886	26.29	26.85	0.78	25.15(12)	25.82	27.40(04)	27.89	2.25	2.07M	26.46	0.030	–0.65
1887	26.46	26.83	0.40	25.74(02)	25.79	27.12(06)	27.84	1.38	2.06	26.60	0.015	–1.05
1888	27.88	26.76	0.55	26.73(01)	25.71	28.86(11)	27.75	2.13	2.04	27.935	0.020	–0.30
1889	26.97	26.66	1.31	25.34(12)	25.62	28.56(01)	27.64	3.22	2.01	27.125	0.049	–0.35
1890	25.78	26.59m	0.84	24.09(01)	25.53m	26.87(05)	27.54m	2.78	2.01	25.74	0.033	0.14
1891	27.06	26.66	0.63	26.13(01)	25.57	27.99(05)	27.56	1.86	1.99	26.82	0.023	1.14
1892	26.23	26.73M	0.76	25.03(11)	25.66M	27.14(05)	27.64M	2.11	1.98	26.335	0.029	–0.41
1893	25.81	26.70	0.47	25.35(01)&	25.63	26.55(05)	27.62	1.20	1.98	25.595	0.018	1.37
1894	26.14	26.64m	0.50	25.49(01)	25.61m	26.87(05)	27.52m	1.38	1.91	26.09	0.019	0.30
1895	27.04	26.76	0.54	25.85(01)	25.77	27.83(05)	27.58	1.98	1.81	27.135	0.020	–0.53
1896	27.63	26.85	0.45	26.74(01)	25.91	28.16(11)	27.64	1.42	1.73m	27.775	0.016	–0.97
1897	27.13	26.93	0.75	26.04(11)	25.97	28.07(01)	27.70	2.03	1.73m	27.42	0.028	–1.16
1898	26.50	27.07	0.53	25.80(12)	26.03	27.40(06)	27.86	1.60	1.82	26.435	0.020	0.37
1899	27.27	27.18	0.73	25.83(01)	26.06	28.09(12)	27.99	2.26	1.93	27.47	0.027	–0.82
1900	27.80	27.27	0.57	26.79(11)	26.15	28.45(06)	28.10	1.66	1.95	27.98	0.021	–0.95
1901	26.94	27.28M	0.55	26.24(12)	26.18M	27.68(05)	28.16M	1.44	1.98	26.995	0.020	–0.30
1902	27.80	27.23	0.82	26.08(01)	26.13	28.67(07)	28.13	2.59	2.00M	28.11	0.029	–1.13
1903	27.06	27.21	0.95	25.57(12)	26.11	28.13(04)	28.10	2.56	1.99m	27.215	0.035	–0.49
1904	27.05	27.16	0.71	25.84(01)	26.06	27.98(07)	28.07	2.14	2.01M	27.235	0.026	–0.78
1905	27.95	27.02	0.45	27.26(01)	25.96	28.94(05)	27.95	1.68	2.00	27.985	0.016	–0.23
1906	27.03	26.93	0.88	25.87(10)	25.88	28.22(04)	27.86	2.35	1.98	27.085	0.033	–0.19
1907	26.69	26.90	0.44	26.01(01)	25.87m	27.39(05)	27.83	1.38	1.97	26.585	0.016	0.72
1908	26.55	26.88m	0.62	25.43(12)	25.91	27.47(06)	27.79m	2.04	1.88	26.535	0.023	0.07
1909	26.19	26.90M	0.69	25.15(11)	26.01	27.50(05)	27.79m	2.35	1.78m	26.06	0.026	0.57
1910	26.13	26.90	0.38	25.46(09)	26.02M	26.65(06)	27.80M	1.19	1.79	26.125	0.015	0.04
1911	26.81	26.83	0.47	26.01(01)	25.93	27.55(12)	27.77	1.54	1.84	26.875	0.018	–0.41
1912	27.28	26.78m	0.72	26.10(12)	25.83	28.35(04)	27.75m	2.25	1.92	27.28	0.026	0.00
1913	27.10	26.81	0.38	26.38(01)	25.80m	27.58(05)	27.79	1.20	2.00	27.04	0.014	0.47
1914	27.56	26.91	0.42	26.96(11)	25.87	28.46(04)	27.87	1.50	2.00	27.57	0.015	–0.07
1915	27.42	27.05	0.75	26.36(12)	25.98	28.78(06)	27.99	2.42	2.01	27.35	0.027	0.28
1916	26.13	27.09M	0.94	24.93(11)	26.02M	27.64(05)	28.05M	2.71	2.03	26.14	0.036	–0.13

Table 1. Annual and 10-yma values of SST in the Niño 3.4 region based on HadSST monthly time series from 1871 to 2008 (Continued).

Year	Mean SST	10-yma	sd	L(M)	10-yma	H(M)	10-yma	H(M)-L(M)	10-yma	Median	CV	PCS
1917	26.64	27.06	0.83	25.02(01)	25.99	27.65(06)	28.03	2.63	2.04	26.695	0.031	-0.20
1918	27.14	27.03	0.78	25.74(01)	25.97	28.06(06)	28.02	2.32	2.05	27.185	0.029	-0.17
1919	27.67	26.98	0.71	26.29(11)	25.88	28.49(05)	27.99	2.20	2.11	27.815	0.026	-0.61
1920	27.28	26.93m	0.44	26.57(11)*	25.77m	27.98(06)	27.92m	1.41	2.15M	27.295	0.016	-0.10
1921	26.61	26.99	0.56	25.62(11)	25.80	27.47(06)	27.95	1.85	2.15M	26.68	0.021	-0.38
1922	26.73	27.08	0.63	26.04(01)	25.97	28.09(05)	28.00M	2.05	2.05	26.585	0.024	0.69
1923	27.09	27.09M	0.58	26.00(02)	26.07	27.62(05)	27.99	1.62	1.92	27.31	0.021	-1.14
1924	26.66	27.06	0.74	25.56(11)	26.11	27.75(04)	27.94	2.19	1.83	26.65	0.028	0.04
1925	27.25	27.06m	0.72	25.55(01)	26.14	28.19(12)	27.93m	2.64	1.79m	27.515	0.026	-1.10
1926	27.58	27.13	0.96	26.34(10)	26.19	28.78(04)	28.02	2.44	1.82	27.96	0.035	-1.19
1927	26.99	27.19M	0.32	26.60(09)	26.23M	27.54(06)	28.08	0.94	1.85	26.96	0.012	0.28
1928	27.00	27.17	0.44	26.49(11)	26.21	27.83(05)	28.09M	1.34	1.89	26.99	0.016	0.07
1929	27.15	27.14	0.41	26.43(01)	26.18m	27.81(06)	28.08	1.38	1.90M	27.12	0.015	0.22
1930	27.78	27.11	0.42	26.93(01)	26.22	28.44(11)	28.02	1.51	1.81	27.865	0.015	-0.61
1931	27.51	27.08	0.94	26.31(12)	26.26M	28.73(04)	27.95	2.42	1.69	27.85	0.034	-1.09
1932	27.06	27.06	0.69	26.16(01)	26.26M	28.14(05)	27.94m	1.98	1.68m	26.87	0.025	0.83
1933	26.44	27.04	0.76	25.38(12)	26.21	27.78(04)	27.96	2.40	1.75	26.46	0.029	-0.08
1934	26.57	27.01	0.56	25.64(01)	26.14	27.37(05)	27.96	1.73	1.82	26.51	0.021	0.32
1935	26.89	27.00m	0.36	26.26(01)	26.10m	27.45(04)	27.96	1.19	1.86M	26.935	0.013	-0.38
1936	27.17	27.03	0.46	26.55(08)	26.15	28.06(04)	27.99	1.51	1.84m	27.235	0.017	-0.42
1937	27.07	27.04M	0.47	26.27(01)	26.16M	27.98(04)	28.02	1.71	1.86	26.995	0.017	0.48
1938	26.60	27.02m	0.67	25.79(12)	26.11m	27.86(04)	28.02	2.07	1.92M	26.42	0.025	0.81
1939	26.87	27.05M	0.66	25.81(02)	26.13	27.74(06)	28.04	1.93	1.91m	26.96	0.025	-0.41
1940	27.80	27.05	0.56	26.80(09)	26.14M	28.57(04)	28.07M	1.77	1.93	27.87	0.020	-0.38
1941	28.17	27.01	0.58	27.43(09)	26.10	29.18(05)	28.06	1.75	1.96	27.95	0.021	1.14
1942	26.61	26.98m	1.08	25.15(11)	26.05	28.34(04)	28.04m	3.19	1.99	26.92	0.041	-0.86
1943	26.55	26.99	0.72	25.38(01)	26.04	27.58(06)	28.04m	2.20	2.01	26.405	0.027	0.60
1944	26.96	27.00M	0.65	26.15(01)	26.03	28.00(05)	28.07M	1.85	2.04	26.90	0.024	0.28
1945	26.44	26.90	0.50	25.87(10)	25.92	27.41(05)	27.99	1.54	2.07	26.26	0.019	0.36
1946	26.85	26.76	0.51	26.14(01)	25.75	27.83(06)	27.84	1.69	2.10M	26.67	0.019	1.06
1947	26.80	26.72m	0.70	25.70(09)	25.69m	27.75(06)	27.78m	2.05	2.08	26.80	0.026	0.00
1948	27.14	26.78	0.68	26.06(10)	25.81	28.17(05)	27.82	2.11	2.01	27.045	0.025	0.42
1949	26.57	26.80M	0.83	25.33(11)	25.84M	27.96(04)	27.84M	2.63	2.00m	26.63	0.031	-0.22
1950	26.00	26.74	0.56	25.26(02)	25.75	26.86(04)	27.78	1.60	2.03	26.02	0.022	-0.11
1951	27.19	26.68m	0.78	25.45(01)	25.66	27.88(07)	27.73m	2.43	2.07	27.47	0.029	-1.08
1952	26.88	26.69	0.59	26.04(12)	25.63m	28.28(04)	27.73m	2.24	2.09M	26.835	0.022	0.23
1953	27.38	26.74	0.60	26.74(12)	25.67	28.54(04)	27.76	1.80	2.09M	27.21	0.022	0.85
1954	26.48	26.79	0.74	25.49(11)	25.73	27.45(04)	27.77	1.96	2.04	26.54	0.028	-0.24
1955	25.88	26.86	0.67	24.75(11)	25.83	26.82(04)	27.82	2.07	2.00	25.94	0.026	-0.27
1956	26.20	26.89M	0.58	25.35(01)	25.91	27.28(05)	27.88M	1.93	1.97	26.05	0.022	0.78
1957	27.55	26.87	0.65	26.02(01)	25.94M	28.31(05)	27.84	2.29	1.90	27.70	0.024	-0.69
1958	27.49	26.86m	0.70	26.44(09)	25.92	28.25(03)	27.77	1.81	1.85	27.625	0.025	-0.58
1959	27.05	26.87	0.58	26.22(09)	25.89m	28.04(04)	27.73m	1.82	1.84m	26.98	0.021	0.36
1960	26.97	26.96	0.52	26.27(11)	25.96	27.92(05)	27.80	1.65	1.85	26.83	0.019	0.81
1961	26.87	27.10	0.66	26.02(10)	26.07	27.90(04)	27.93	1.88	1.86M	26.71	0.025	0.73
1962	26.73	27.11M	0.51	26.09(12)	26.11M	27.47(06)	27.95M	1.38	1.84	26.67	0.019	0.35

Table 1. Annual and 10-yma values of SST in the Niño 3.4 region based on HadSST monthly time series from 1871 to 2008 (Continued).

Year	Mean SST	10-yma	sd	L(M)	10-yma	H(M)	10-yma	H(M)-L(M)	10-yma	Median	CV	PCS
1963	27.42	27.05m	0.53	26.26(01)	26.09m	27.95(07)	27.90	1.69	1.81	27.60	0.019	-1.02
1964	26.52	27.05	0.73	25.52(12)	26.12	27.33(01)	27.89m	1.81	1.77m	26.695	0.028	-0.72
1965	27.66	27.07M	0.77	26.01(01)	26.13M	28.34(10)	27.90M	2.33	1.77m	28.035	0.028	-1.46
1966	27.29	27.02m	0.70	26.28(11)	26.04	28.31(04)	27.86m	2.03	1.82	27.52	0.026	-0.99
1967	26.68	27.04	0.57	26.02(01)	25.99	27.63(05)	27.88	1.61	1.89	26.46	0.021	1.16
1968	27.04	27.04M	0.60	25.98(01)	25.89	27.87(06)	27.96M	1.89	2.06	27.25	0.022	-1.05
1969	27.62	26.97	0.35	27.22(09)	25.75	28.25(05)	27.96M	1.03	2.20	27.44	0.013	1.54
1970	26.71	26.87	0.88	25.47(12)	25.65	27.95(04)	27.88	2.48	2.23	26.685	0.033	0.09
1971	26.13	26.77m	0.60	25.11(01)	25.53	27.04(05)	27.80	1.93	2.27	25.98	0.023	0.75
1972	27.84	26.80	0.86	26.00(01)	25.51m	28.78(12)	27.79	2.78	2.28M	28.12	0.031	-0.98
1973	26.41	26.83M	1.37	24.41(12)	25.57M	28.18(01)	27.78	3.77	2.21	26.455	0.052	-0.10
1974	26.12	26.81m	0.75	24.56(01)	25.55m	27.07(05)	27.74	2.51	2.20	26.19	0.029	-0.28
1975	26.02	26.81	0.73	24.95(12)	25.58	27.18(04)	27.73m	2.23	2.16	26.10	0.028	-0.33
1976	26.98	26.88	0.88	24.78(01)	25.69	27.69(06)	27.77	2.91	2.09	27.335	0.033	-1.21
1977	27.56	26.92	0.27	27.13(08)	25.76	28.05(06)	27.82	0.92	2.05	27.635	0.010	-0.83
1978	26.88	26.98	0.48	26.15(09)	25.85	27.40(04)	27.87	1.25	2.02	26.99	0.018	-0.69
1979	27.25	27.05M	0.39	26.63(01)	25.93	27.94(04)	27.91M	1.31	1.99	27.16	0.014	0.69
1980	27.20	27.07m	0.54	26.63(09)*	25.99	28.05(06)	27.91M	1.42	1.92	27.11	0.020	0.50
1981	26.87	27.10	0.54	26.12(01)	26.07	27.76(05)	27.90m	1.64	1.83	26.70	0.020	0.94
1982	27.98	27.15M	0.81	26.54(01)	26.15M	28.92(12)	27.95	2.38	1.80m	28.075	0.029	-0.35
1983	27.51	27.14	1.48	25.52(11)	26.09	29.01(01)	28.00M	3.49	1.90	27.71	0.054	-0.41
1984	26.34	27.05	0.68	25.05(12)	25.91	27.22(05)	27.96	2.17	2.05	26.435	0.026	-0.42
1985	26.35	27.00m	0.41	25.69(01)	25.81m	26.97(05)	27.92m	1.28	2.11	26.26	0.016	0.66
1986	27.15	27.04	0.62	25.79(01)	25.85	27.70(11)	27.96	1.91	2.11	27.37	0.023	-1.06
1987	28.29	27.07M	0.41	27.64(12)	25.88	28.92(06)	28.00	1.28	2.12M	28.32	0.014	-0.22
1988	26.04	27.05m	1.14	24.48(11)	25.94	27.54(03)	28.00	3.06	2.06	25.96	0.044	0.21
1989	26.27	27.11	0.69	24.63(01)	26.08	27.06(05)	28.03	2.43	1.95m	26.365	0.026	-0.41
1990	27.24	27.20	0.51	26.60(01)	26.17	28.19(05)	28.12	1.59	1.96	27.085	0.019	0.91
1991	27.66	27.21M	0.49	26.98(09)	26.18M	28.34(06)	28.17	1.36	1.99	27.715	0.018	-0.34
1992	27.69	27.18m	1.08	26.39(10)	26.11	29.18(04)	28.17	2.79	2.06	27.845	0.039	-0.43
1993	27.50	27.24	0.72	26.77(12)	26.07m	28.79(05)	28.25	2.02	2.18	27.135	0.026	1.52
1994	27.44	27.28M	0.48	26.60(02)	26.12M	28.00(05)	28.32M	1.40	2.20	27.515	0.017	-0.47
1995	27.04	27.21	0.88	25.86(12)	26.05	28.04(04)	28.26	2.18	2.21	27.45	0.033	-1.40
1996	26.69	27.11	0.57	25.93(01)	25.90	27.57(06)	28.17	1.64	2.27M	26.52	0.021	0.89
1997	28.25	27.06	1.04	26.15(01)	25.83m	29.08(11)	28.09	2.93	2.26	28.835	0.037	-1.69
1998	27.14	27.05	1.54	25.08(12)	25.84	29.00(01)	27.99	3.92	2.15	26.895	0.057	0.48
1999	25.97	27.04m	0.72	25.04(12)	25.86	26.99(05)	27.92m	1.95	2.06m	25.90	0.028	0.29
2000	26.19	27.04	0.71	24.79(01)	25.87M	27.07(05)	27.93	2.28	2.06m	26.27	0.027	-0.34
2001	26.73	27.07M	0.62	25.70(01)	25.85	27.58(06)	27.94M	1.88	2.09	26.625	0.023	0.51
2002	27.65	27.00	0.56	26.44(01)	25.78	28.37(06)	27.88	1.93	2.10M	27.845	0.020	-1.04
2003	27.30	26.88	0.31	26.90(09)	25.71	27.56(01)	27.72	0.66	2.01	27.355	0.011	-0.53
2004	27.43	-	0.35	26.84(01)	-	27.96(05)	-	1.12	-	27.44	0.013	-0.09
2005	27.10	-	0.73	25.83(12)	-	28.16(05)	-	2.33	-	27.08	0.027	0.08
2006	27.16	-	0.71	25.60(01)	-	27.78(06)	-	2.18	-	27.425	0.026	-1.12
2007	26.50	-	0.99	24.98(12)	-	27.61(04)	-	2.63	-	26.87	0.037	-1.12

Table 1. Annual and 10-yma values of SST in the Niño 3.4 region based on HadSST monthly time series from 1871 to 2008 (Continued).

Year	Mean SST	10-yma	sd	L(M)	10-yma	H(M)	10-yma	H(M)-L(M)	10-yma	Median	CV	PCS
2008	26.35	–	0.82	24.79(01)	–	27.24(06)	–	2.45	–	26.45	0.031	–0.37
2009	–	–	–	–	–	–	–	–	–	–	–	–
Statistics (Based on 1871–2008)												
	Mean SST	L(M)		H(M)		H(M)-L(M)						
mean	26.95	25.92		27.87		1.97						
sd	0.57	0.66		0.58		0.57						
low	25.78(1890)	24.09(1890)		26.55(1893)		0.66(2003)						
high	28.30(1877)	27.64(1987)		29.19(1878)		3.92(1998)						
H-L	2.52	3.55		2.64		3.26						
median	26.985	25.99		27.865		1.93						
na	69	69		69		69						
nb	69	69		69		69						
nra	28	29		33		30						
z	–2.38	–2.04		–0.68		–1.70						
random?	no	no		yes		yes						
±50% PI	0.39	0.45		0.39		0.39						
CV	0.021	0.025		0.021		0.289						
PCS	–0.18	–0.32		0.03		0.21						

Notes: Mean SST = monthly mean sea surface temperature in the year, based on the Hadley dataset and measured in degrees Celsius.

sd = standard deviation.

L(M) = lowest monthly value in the year and the month it occurs.

H(M) = highest monthly value in the year and the month it occurs.

H-L = range.

na = number of yearly values above the median.

nb = number of yearly values below the median.

nra = number of runs above the median value.

z = normal deviate calculated from nra, na and nb; when  $z < -1.96$  or  $> 1.96$ , hypothesis testing suggests that the distribution is nonrandom.

PI = prediction interval.

CV = coefficient of variation, equal to  $sd/\text{Mean SST}$ .

PCS = Pearson coefficient of skewness, equal to  $3(\text{Mean SST} - \text{Median})/sd$ .

\* = also following month.

& = also seen in November 1893.

M refers to local maximum values within a string of yearly values.

m refers to local minimum values within a string of yearly values.

Table 2. Frequency of occurrence of monthly high and low values of SST in the Niño 3.4 region based on HadSST values from 1871 to 2008.

Month	Monthly High Value Occurrence		Monthly Low Value Occurrence	
	f	Percent	f	Percent
01	7	0.051	58	0.420
02	1	0.007	7	0.051
03	2	0.014	0	0.000
04	36	0.261	0	0.000
05	47	0.341	0	0.000
06	29	0.210	0	0.000
07	4	0.029	0	0.000
08	0	0.000	2	0.014
09	0	0.000	12	0.087
10	1	0.007	6	0.043
11	5	0.036	23	0.167
12	6	0.043	30	0.217
Total	138	100.000	138	1.000

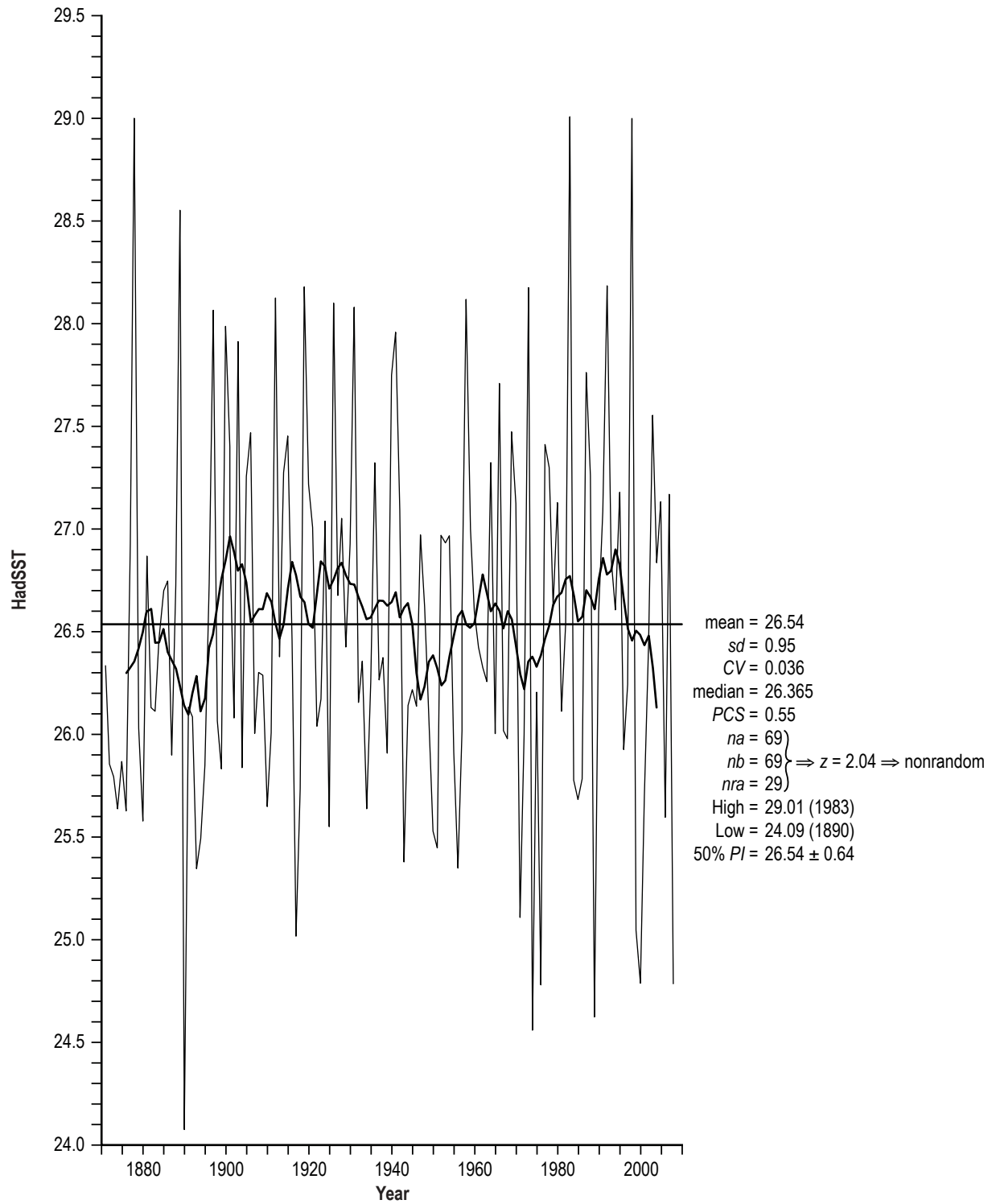


Figure 3. Annual and 10-y-ma values of January values of HadSST in the Niño 3.4 region from 1871 to 2009.

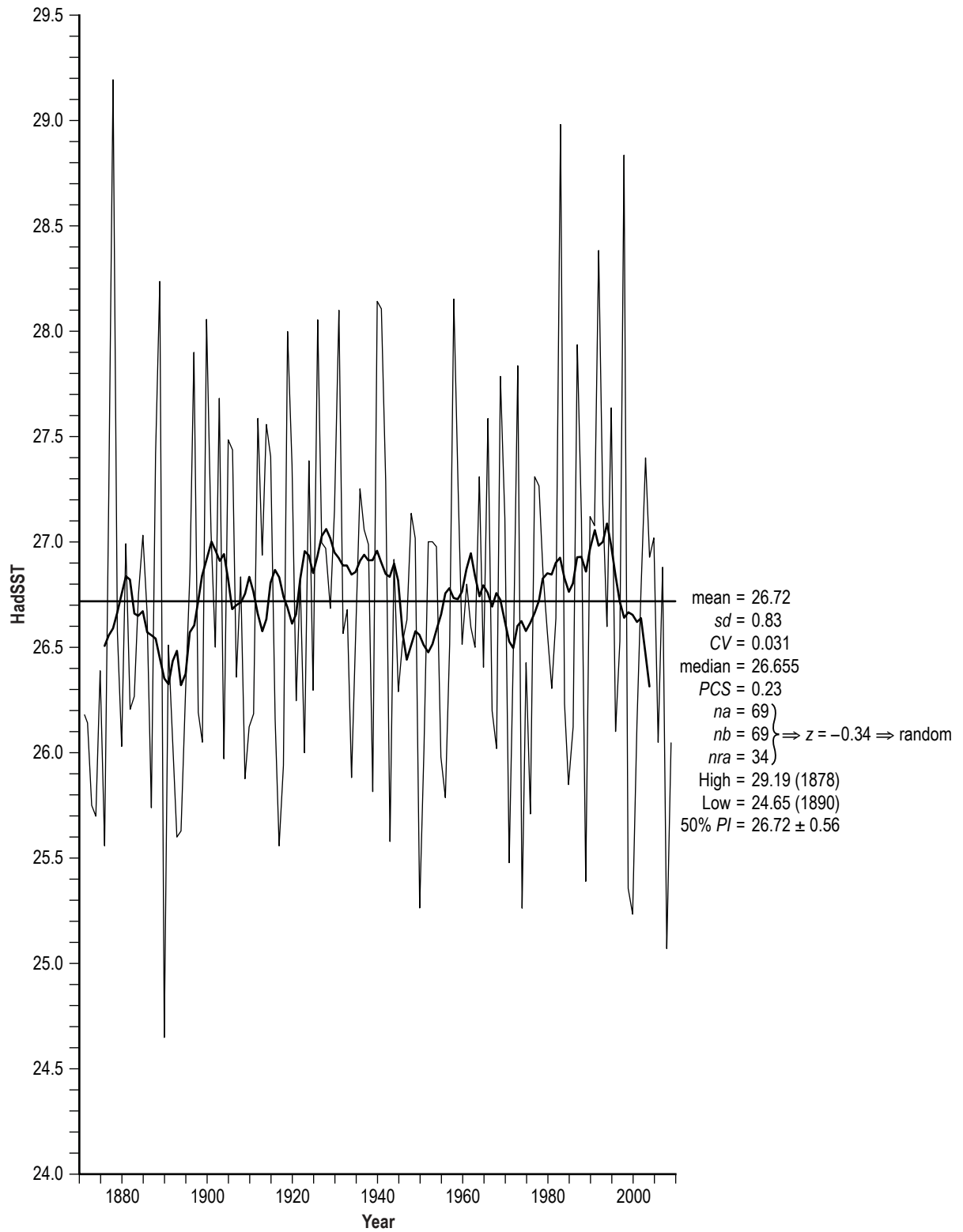


Figure 4. Annual and 10-yma values of February values of HadSST in the Niño 3.4 region from 1871 to 2009.



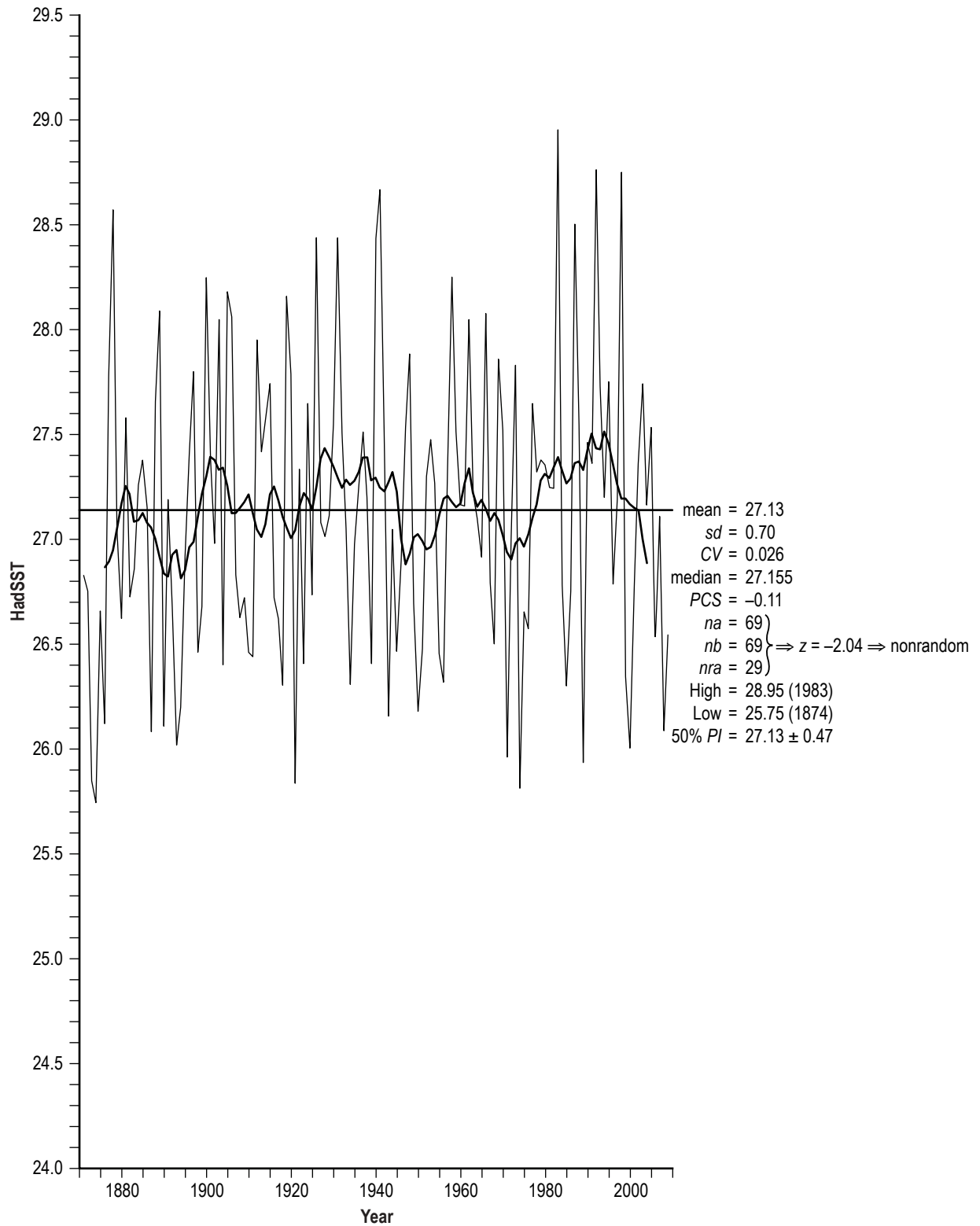


Figure 5. Annual and 10-yma values of March values of HadSST in the Niño 3.4 region from 1871 to 2008.

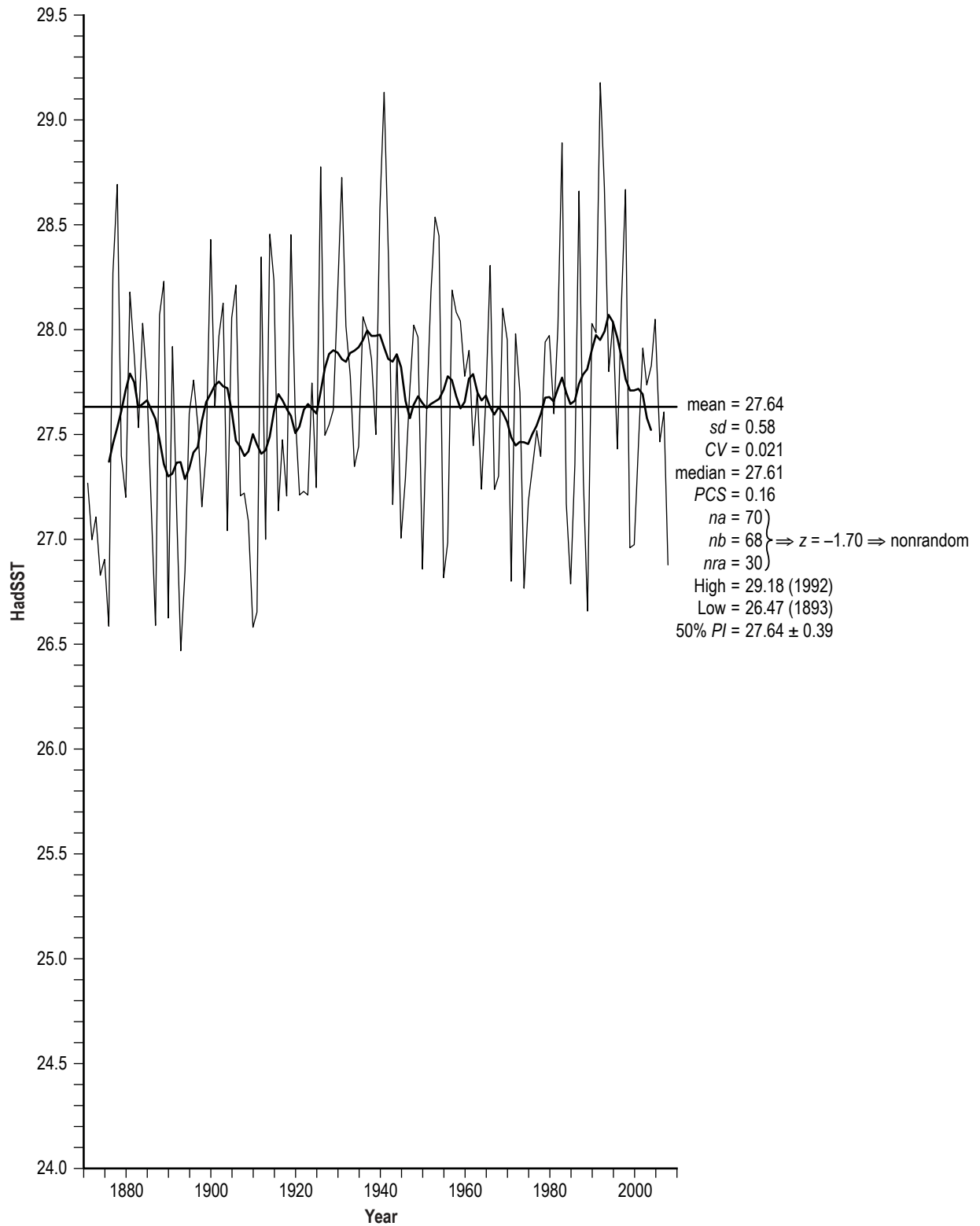


Figure 6. Annual and 10-yma values of April values of HadSST in the Niño 3.4 region from 1871 to 2008.

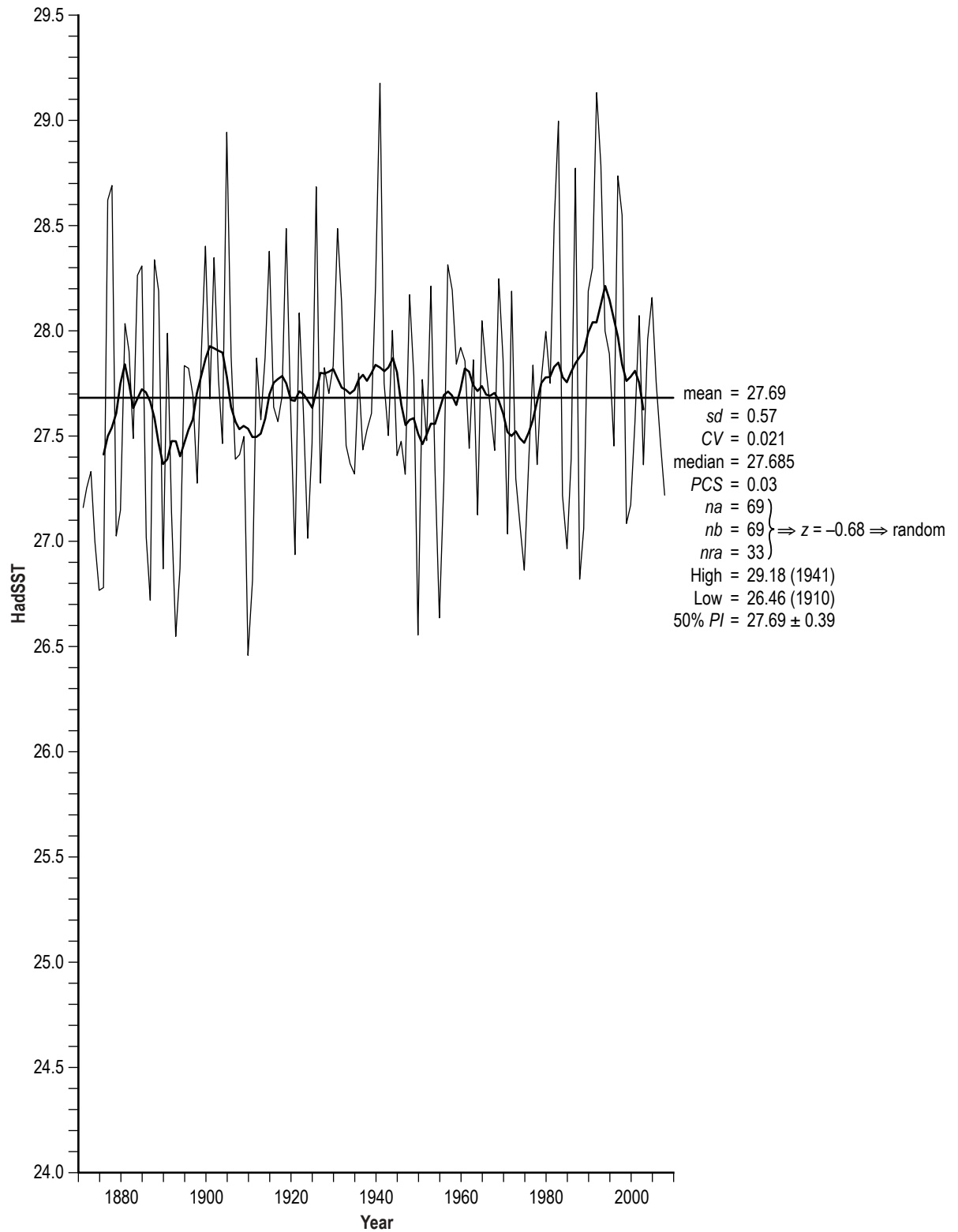


Figure 7. Annual and 10-yma values of May values of HadSST in the Niño 3.4 region from 1871 to 2008.

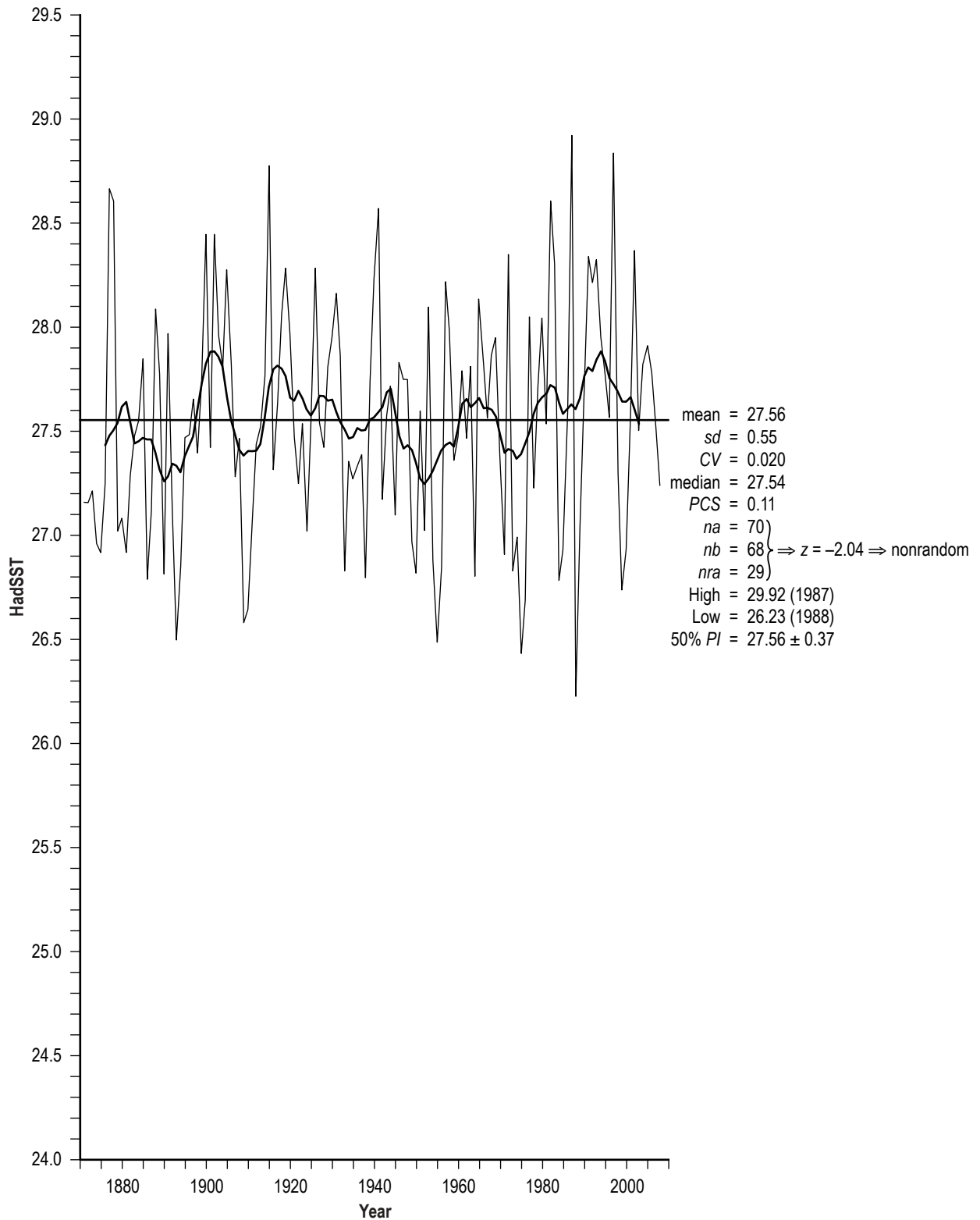


Figure 8. Annual and 10-yma values of June values of HadSST in the Niño 3.4 region from 1871 to 2008.

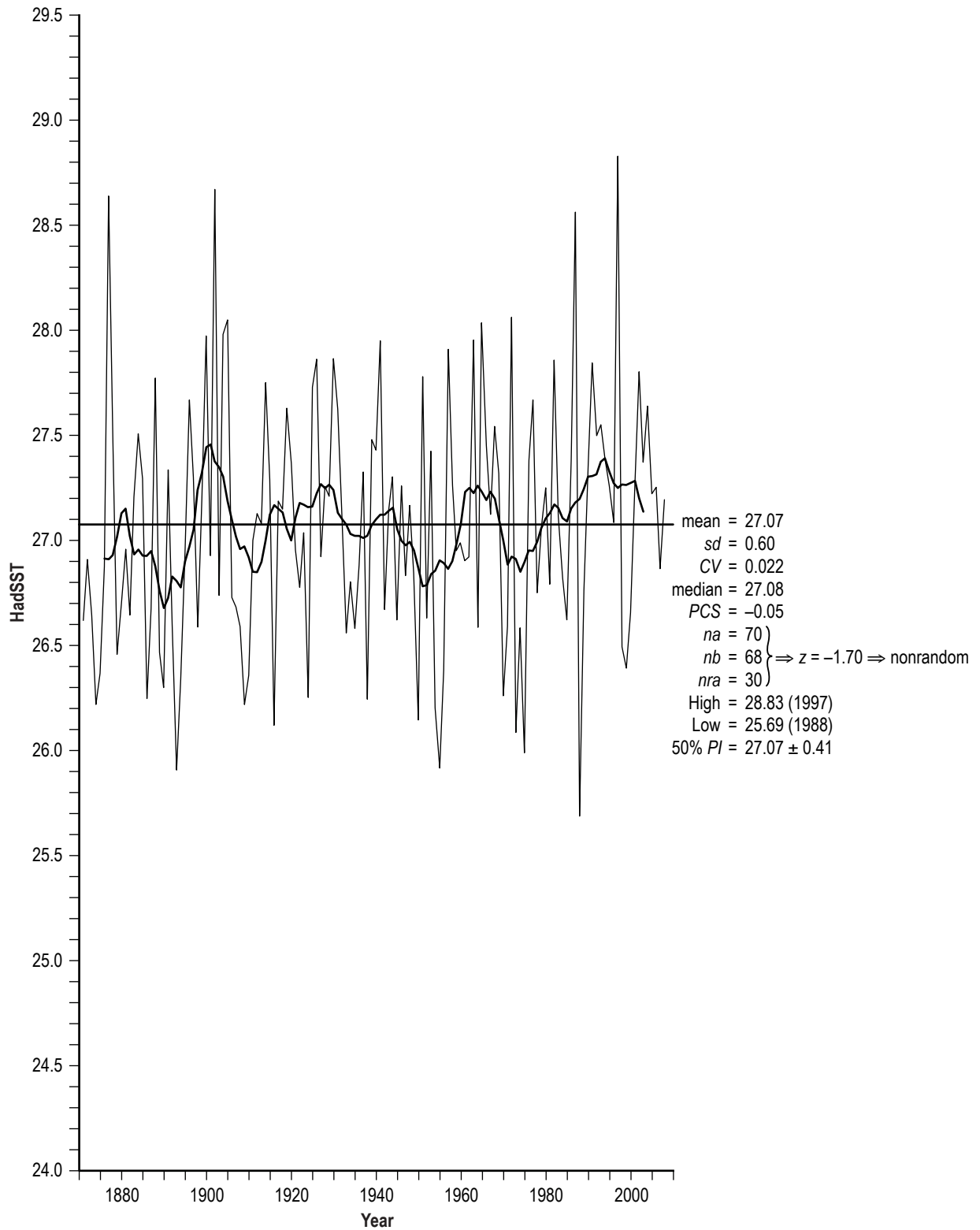


Figure 9. Annual and 10-yma values of July values of HadSST in the Niño 3.4 region from 1871 to 2008.

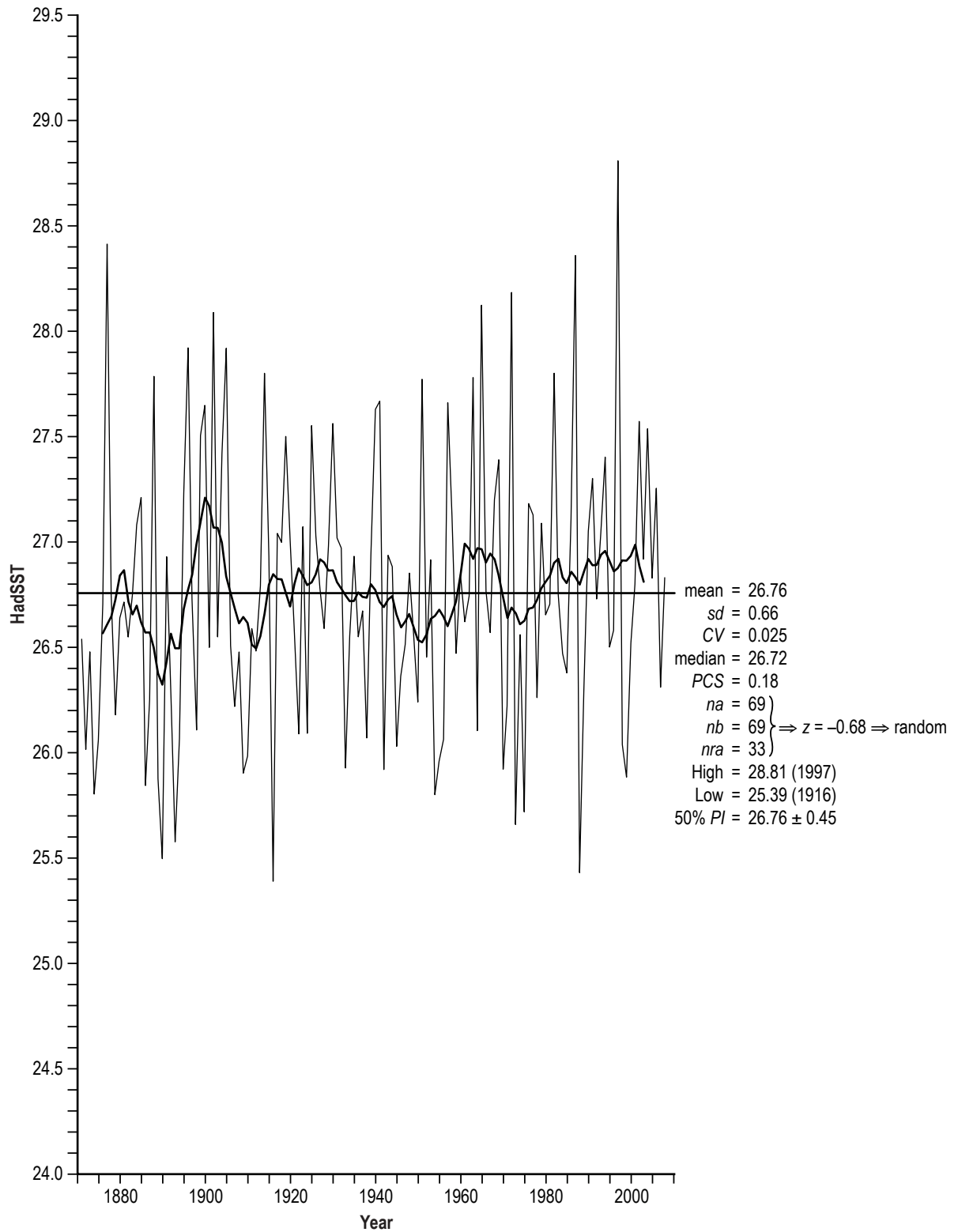


Figure 10. Annual and 10-yma values of August values of HadSST in the Niño 3.4 region from 1871 to 2008.

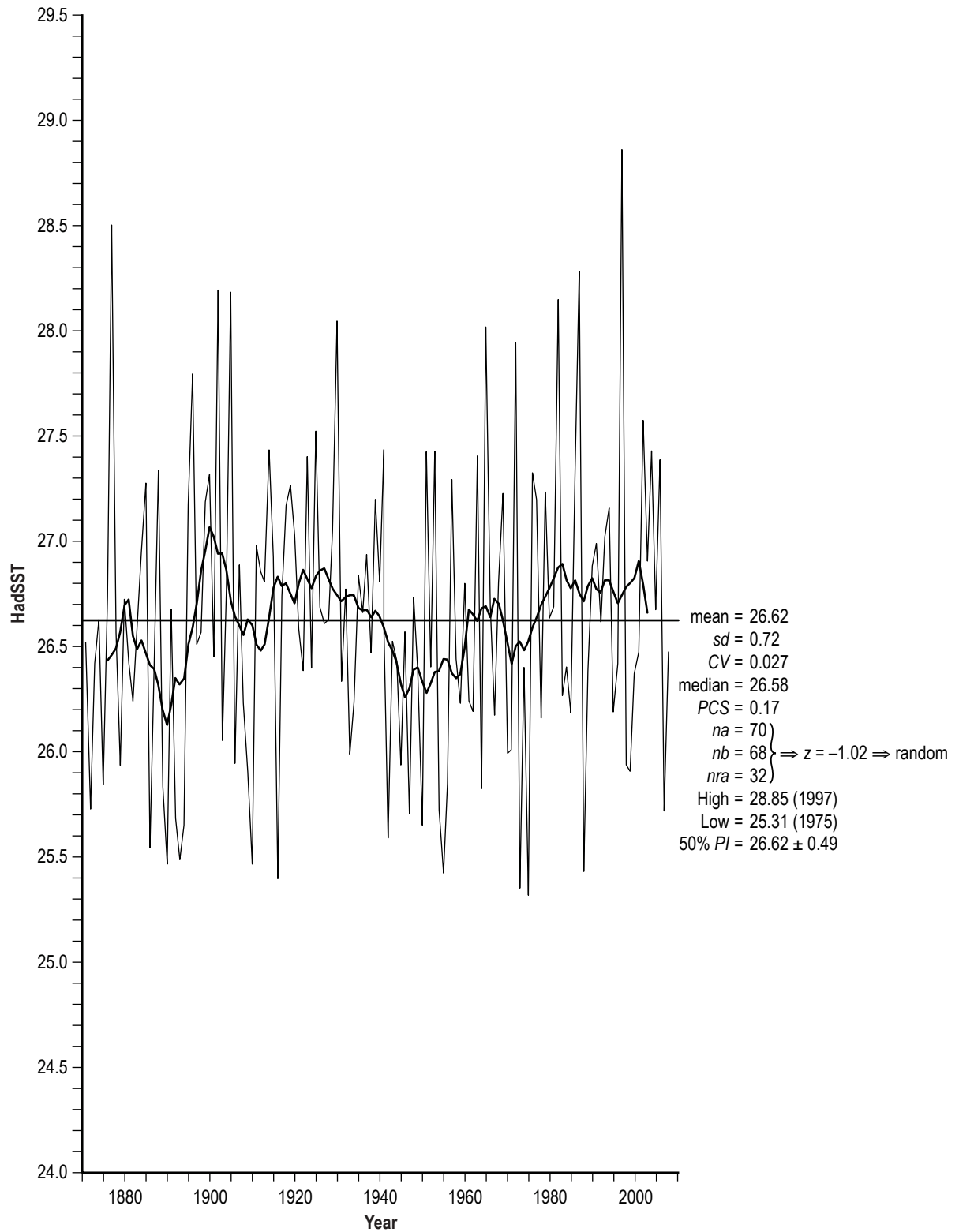


Figure 11. Annual and 10-yma values of September values of HadSST in the Niño 3.4 region from 1871 to 2008.

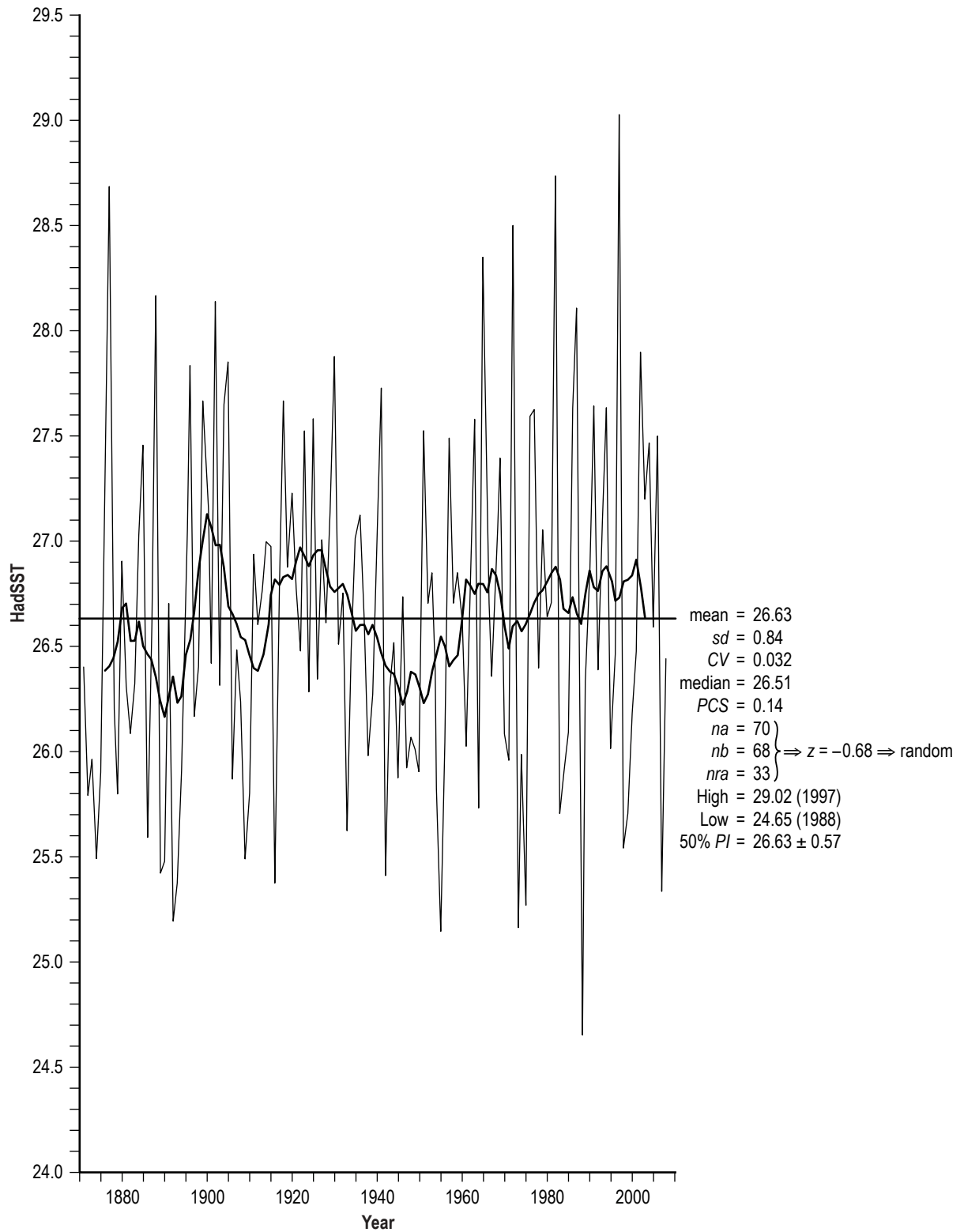


Figure 12. Annual and 10-yma values of October values of HadSST in the Niño 3.4 region from 1871 to 2008.



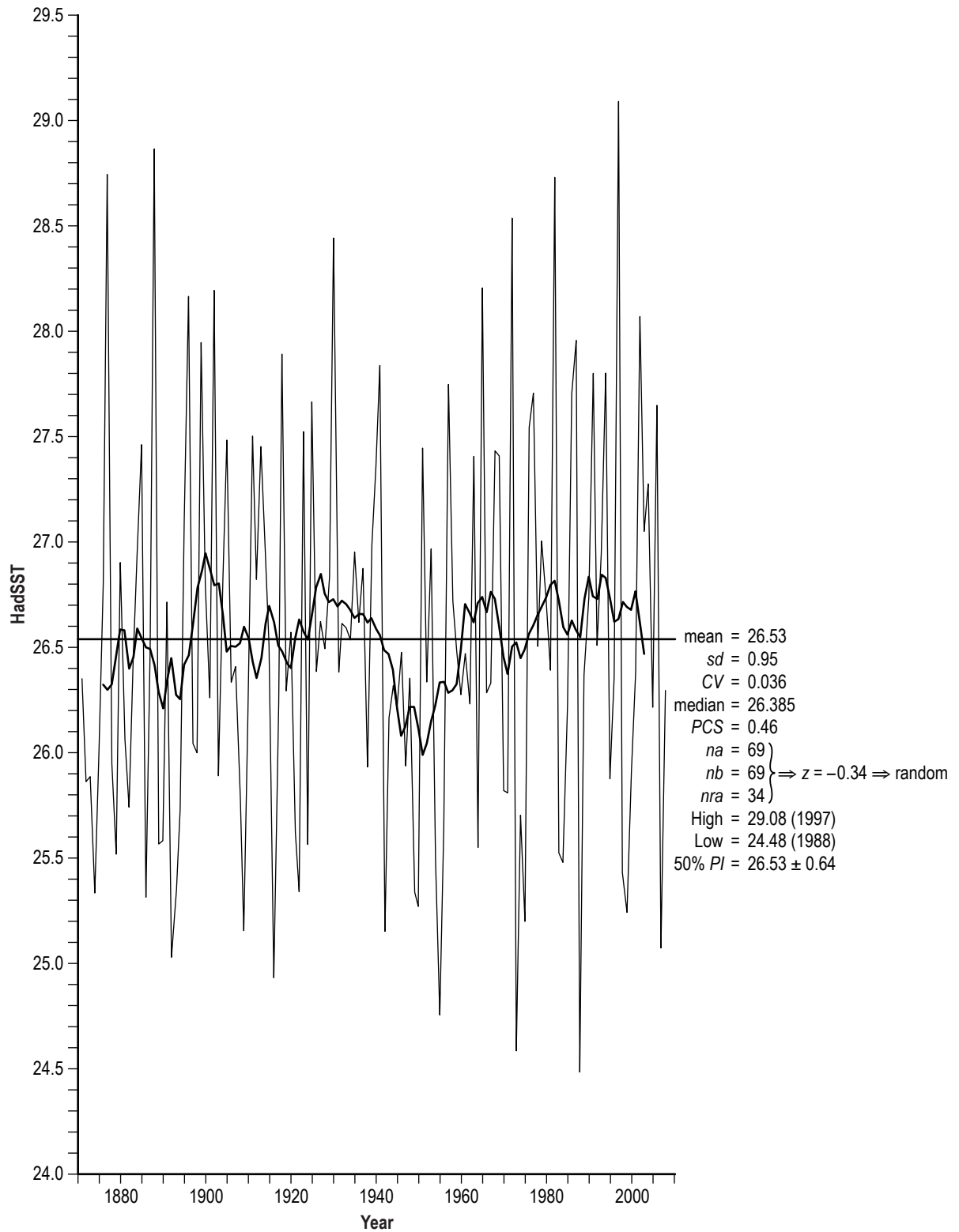


Figure 13. Annual and 10-yma values of November values of HadSST in the Niño 3.4 region from 1871 to 2008.

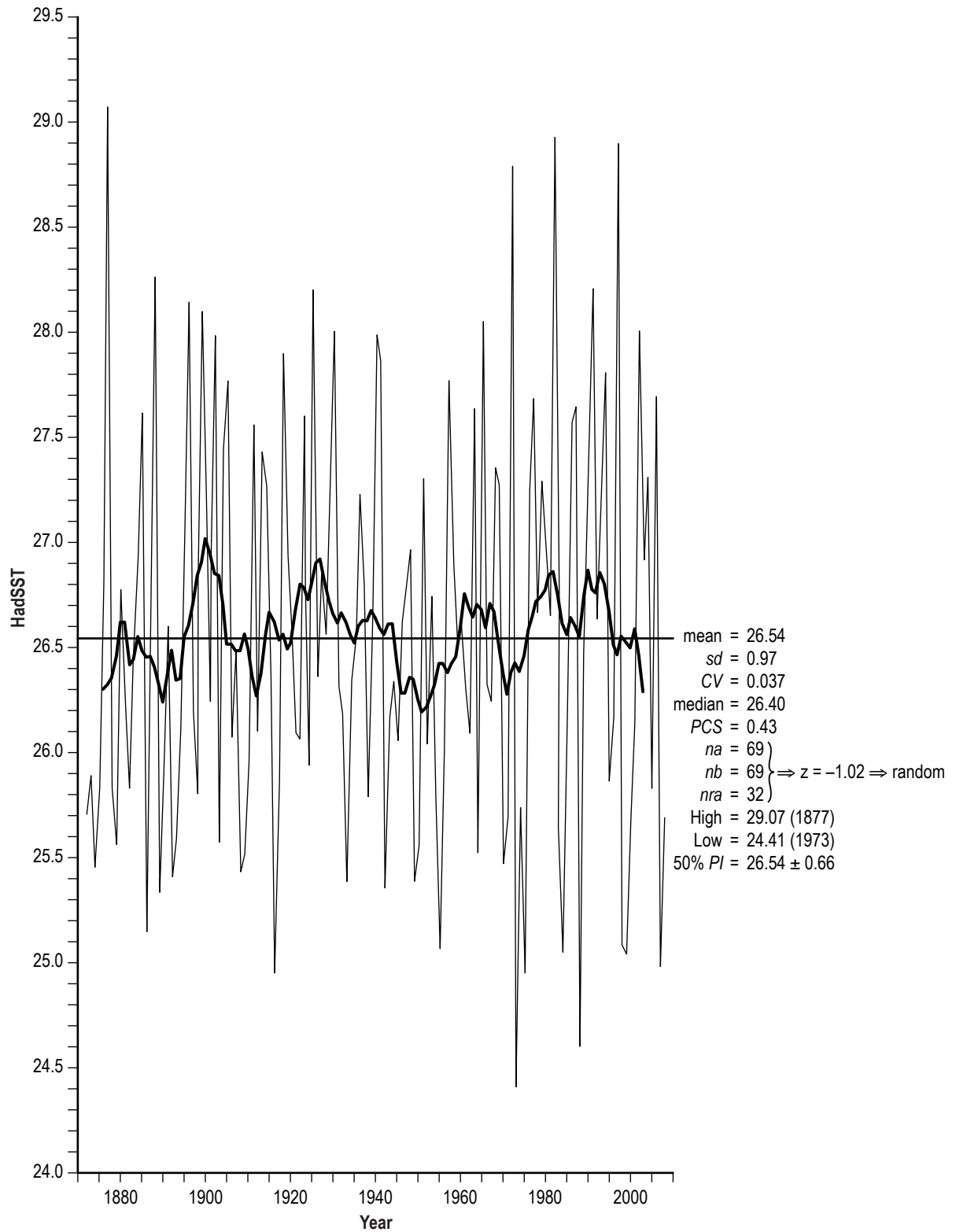


Figure 14. Annual and 10-yma values of December values of HadSST in the Niño 3.4 region from 1871 to 2008.

Table 3. HadSST monthly and 10-yma values for the Niño 3.4 region from 1871 to April 2009.

Year	January		February		March		April		May		June		July		August		September		October		November		December	
	Mon	10-yma	Mon	10-yma	Mon	10-yma	Mon	10-yma	Mon	10-yma	Mon	10-yma	Mon	10-yma	Mon	10-yma	Mon	10-yma	Mon	10-yma	Mon	10-yma	Mon	10-yma
1871	26.33	-	26.18	-	26.83	-	27.27	-	27.16	-	27.16	-	26.62	-	26.54	-	26.51	-	26.40	-	26.35	-	26.01	-
1872	25.86	-	26.14	-	26.76	-	27.00	-	27.25	-	27.16	-	26.91	-	26.02	-	25.73	-	25.79	-	25.86	-	25.71	-
1873	25.79	-	25.75	-	25.95	-	27.10	-	27.33	-	27.21	-	26.65	-	26.48	-	26.41	-	25.96	-	25.88	-	25.89	-
1874	25.64	-	25.70	-	25.85	-	26.83	-	27.00	-	26.96	-	26.22	-	25.82	-	25.62	-	25.49	-	25.33	-	25.45	-
1875	25.87	-	26.39	-	26.66	-	26.90	-	26.77	-	26.92	-	26.37	-	26.06	-	25.84	-	25.90	-	26.01	-	25.83	-
1876	25.63	26.29	25.56	26.51	26.13	26.86	26.59	27.37	26.78	27.42	27.25	27.44	26.88	26.91	26.71	26.57	26.73	26.44	26.85	26.39	26.80	26.32	26.81	26.30
1877	26.93	26.33	27.22	26.56	27.78	26.89	28.27	27.46	28.62	27.50	28.67	27.49	28.64	26.91	28.42	26.61	28.50	26.46	28.68	26.40	28.74	26.30	29.07	26.32
1878	28.99	26.36	29.19	26.59	28.57	26.94	28.69	27.53	28.69	27.54	28.61	27.51	27.48	26.93	26.76	26.65	26.43	26.49	26.20	26.44	25.95	26.32	25.83	26.35
1879	26.03	26.42	26.58	26.67	27.02	27.05	27.40	27.61	27.03	27.61	27.02	27.55	26.46	27.02	26.18	26.73	25.93	26.57	25.80	26.53	25.52	26.46	25.56	26.46
1880	25.58	26.50	26.03	26.75	26.63	27.16	27.20	27.71	27.15	27.75	27.08	27.63	26.70	27.13	26.63	26.85	26.72	26.70	26.90	26.68	26.90	26.58	26.77	26.62
1881	26.87	26.60	26.99	26.84	27.58	27.25	28.18	27.79	28.03	27.84	27.92	27.65	26.96	27.15	26.71	26.87	26.42	26.72	26.31	26.70	26.06	26.58	26.22	26.62
1882	26.13	26.61	26.21	26.82	26.73	27.21	27.87	27.75	27.88	27.75	27.29	27.55	26.65	27.02	26.55	26.72	26.24	26.55	26.08	26.53	25.74	26.40	25.83	26.42
1883	26.12	26.44	26.27	26.66	26.86	27.08	27.54	27.63	27.49	27.64	27.48	27.45	27.21	26.94	26.85	26.66	26.58	26.49	26.32	26.53	26.43	26.45	26.44	26.43
1884	26.47	26.45	26.75	26.65	27.26	27.09	28.03	27.64	28.26	27.68	27.55	27.46	27.51	26.95	27.08	26.70	26.94	26.53	27.02	26.61	26.95	26.59	26.93	26.54
1885	26.70	26.51	27.03	26.67	27.38	27.12	27.75	27.66	28.30	27.72	27.85	27.48	27.30	26.93	27.21	26.62	27.27	26.47	27.45	26.51	27.46	26.53	27.61	26.49
1886	26.75	26.40	26.67	26.57	27.15	27.07	27.40	27.62	27.02	27.71	26.79	27.47	26.25	26.93	25.85	26.58	25.54	26.41	25.59	26.46	25.31	26.50	25.15	26.46
1887	25.90	26.36	25.74	26.56	26.08	27.05	26.59	27.57	26.72	27.67	27.12	27.47	26.68	26.95	26.25	26.58	26.41	26.40	26.61	26.44	26.69	26.49	26.74	26.46
1888	26.73	26.31	27.42	26.54	27.66	27.00	28.07	27.47	28.34	27.59	28.09	27.41	27.78	26.88	27.80	26.50	27.33	26.32	28.16	26.35	28.86	26.41	28.26	26.40
1889	28.56	26.23	28.24	26.45	28.09	26.91	28.23	27.36	28.19	27.47	27.78	27.32	26.47	26.76	25.88	26.38	25.83	26.20	25.42	26.24	25.57	26.29	25.34	26.31
1890	24.09	26.14	24.65	26.35	26.11	26.83	26.63	27.30	26.87	27.38	26.82	27.27	26.30	26.68	25.50	26.33	25.46	26.13	25.47	26.17	25.58	26.21	25.90	26.24
1891	26.13	26.09	26.51	26.33	27.19	26.82	27.92	27.31	27.99	27.39	27.97	27.29	27.34	26.73	26.93	26.44	26.67	26.23	26.70	26.26	26.71	26.34	26.60	26.37
1892	26.08	26.20	26.42	26.44	26.68	26.92	27.12	27.37	27.14	27.48	27.12	27.35	26.60	26.83	26.25	26.57	25.68	26.35	25.19	26.35	25.03	26.45	25.41	26.49
1893	25.35	26.28	25.60	26.49	26.02	26.94	26.47	27.37	26.55	27.48	26.50	27.34	25.91	26.81	25.58	26.50	25.48	26.32	25.37	26.24	25.35	26.27	25.59	26.34
1894	25.49	26.11	25.63	26.32	26.20	26.81	26.85	27.29	26.87	27.41	26.85	27.31	26.34	26.78	26.07	26.50	25.65	26.35	25.91	26.26	25.73	26.25	26.11	26.35
1895	25.85	26.17	26.28	26.38	26.86	26.85	27.60	27.34	27.83	27.47	27.47	27.39	26.96	26.90	27.23	26.69	27.17	26.51	27.05	26.46	27.10	26.42	27.07	26.55
1896	26.74	26.42	26.85	26.58	27.41	26.96	27.76	27.42	27.82	27.53	27.48	27.44	27.66	26.97	27.92	26.78	27.79	26.59	27.83	26.53	28.16	26.46	28.14	26.60
1897	28.07	26.49	27.90	26.61	27.80	26.98	27.55	27.44	27.69	27.58	27.66	27.48	27.29	27.05	26.73	26.85	26.51	26.70	26.17	26.66	26.04	26.78	25.80	26.71
1898	26.07	26.62	26.19	26.72	26.47	27.10	27.16	27.57	27.28	27.70	27.40	27.62	26.59	27.24	26.11	26.99	26.56	26.86	26.40	26.86	26.00	26.60	26.78	26.84
1899	25.83	26.76	26.05	26.84	26.69	27.21	27.43	27.66	27.90	27.79	27.78	27.74	27.20	27.32	27.51	27.10	27.18	26.95	27.66	26.99	27.94	26.86	28.09	26.90
1900	27.99	26.85	28.06	26.92	28.25	27.29	28.43	27.70	28.40	27.87	28.45	27.83	27.97	27.45	27.65	27.21	27.31	27.06	27.15	27.12	26.79	26.94	27.19	27.01
1901	27.40	26.96	27.06	27.00	27.30	27.39	27.64	27.74	27.68	27.93	27.43	27.89	26.93	27.46	26.50	27.17	26.45	27.02	26.42	27.06	26.26	26.86	26.24	26.94
1902	26.08	26.89	26.50	26.96	26.99	27.37	27.97	27.75	28.34	27.92	28.45	27.89	28.67	27.38	28.09	27.07	28.19	26.94	28.13	26.98	28.19	26.79	27.98	26.85
1903	27.91	26.80	27.69	26.91	28.05	27.33	28.13	27.73	27.77	27.91	27.98	27.87	26.74	27.35	26.55	27.07	26.15	26.94	26.31	26.98	25.89	26.80	25.57	26.84
1904	25.84	26.83	25.97	26.94	26.40	27.34	27.05	27.76	27.47	27.90	27.83	27.82	27.98	27.31	27.42	27.00	26.76	26.86	27.65	26.87	26.81	26.65	27.44	26.70
1905	27.26	26.74	27.48	26.83	28.18	27.25	28.06	27.61	28.94	27.78	28.28	27.67	28.05	27.18	27.92	26.84	28.18	26.71	27.85	26.69	27.48	26.48	27.76	26.51
1906	27.47	26.55	27.44	26.69	28.06	27.12	28.22	27.47	27.88	27.64	27.83	27.56	26.73	27.10	26.51	26.76	25.94	26.64	25.87	26.65	26.33	26.50	26.07	26.51
1907	26.01	26.58	26.36	26.70	26.83	27.12	27.21	27.44	27.39	27.57	27.28	27.49	26.68	27.02	26.22	26.69	26.88	26.60	26.48	26.60	26.40	26.50	26.49	26.48
1908	26.30	26.61	26.83	26.72	26.63	27.14	27.22	27.40	27.41	27.54	27.47	27.42	26.59	26.96	26.48	26.62	26.23	26.56	26.23	26.54	25.78	26.51	25.43	26.48
1909	26.29	26.61	25.88	26.76	26.72	27.17	27.09	27.42	27.50	27.55	26.59	27.39	26.22	26.97	25.90	26.65	25.90	26.63	25.49	26.53	25.15	26.59	25.51	26.56
1910	25.65	26.69	26.12	26.83	26.46	27.21	26.59	27.50	26.46	27.54	26.65	27.41	26.35	26.92	25.98	26.62	25.46	26.60	25.80	26.46	26.13	26.55	25.95	26.49

Table 3. HadSST monthly and 10-yma values for the Niño 3.4 region from 1871 to April 2009 (Continued).

Year	January		February		March		April		May		June		July		August		September		October		November		December	
	Mon	10-yma	Mon	10-yma	Mon	10-yma	Mon	10-yma	Mon	10-yma	Mon	10-yma	Mon	10-yma	Mon	10-yma	Mon	10-yma	Mon	10-yma	Mon	10-yma	Mon	10-yma
1911	26.01	26.65	26.18	26.77	26.44	27.12	26.66	27.45	26.82	27.50	27.05	27.41	27.01	26.85	26.59	26.51	26.97	26.51	26.93	26.39	27.50	26.43	27.55	26.36
1912	28.13	26.55	27.59	26.66	27.95	27.04	28.35	27.41	27.87	27.50	27.44	27.41	27.12	26.85	26.48	26.50	26.85	26.48	26.60	26.38	26.82	26.35	26.10	26.27
1913	26.38	26.47	26.94	26.58	27.42	27.01	27.00	27.42	27.58	27.52	27.53	27.45	27.08	26.90	26.79	26.56	26.80	26.51	26.76	26.46	27.45	26.45	27.43	26.37
1914	27.28	26.54	27.56	26.64	27.58	27.07	28.46	27.49	27.87	27.59	27.77	27.57	27.75	27.00	27.80	26.67	27.43	26.63	26.99	26.60	26.96	26.61	27.27	26.56
1915	27.46	26.71	27.41	26.81	27.75	27.21	28.24	27.61	28.38	27.70	28.78	27.72	27.29	27.12	26.93	26.80	26.92	26.78	26.97	26.74	26.51	26.69	26.36	26.66
1916	26.46	26.84	26.16	26.87	26.72	27.24	27.14	27.69	27.64	27.76	27.32	27.81	26.12	27.17	25.39	26.85	25.39	26.83	25.37	26.81	24.93	26.62	24.95	26.62
1917	25.02	26.78	25.56	26.83	26.62	27.18	27.48	27.66	27.57	27.78	27.65	27.82	27.18	27.15	27.03	26.83	26.73	26.79	26.77	26.79	26.23	26.50	25.87	26.54
1918	25.74	26.67	25.94	26.74	26.30	27.10	27.21	27.62	27.70	27.79	28.06	27.81	27.15	27.13	27.00	26.83	27.16	26.80	27.66	26.82	27.89	26.48	27.89	26.55
1919	28.18	26.65	28.00	26.69	28.16	27.05	28.46	27.59	28.49	27.75	28.29	27.77	27.63	27.05	27.50	26.76	27.26	26.75	26.87	26.83	26.29	26.42	26.93	26.49
1920	27.22	26.54	27.37	26.62	27.79	27.01	27.61	27.51	27.66	27.67	27.98	27.67	27.37	27.07	27.01	26.70	27.02	26.70	27.22	26.82	26.57	26.40	26.57	26.52
1921	27.01	26.53	26.25	26.66	25.84	27.04	27.22	27.54	26.94	27.67	27.47	27.66	26.95	27.11	26.59	26.81	26.58	26.80	26.77	26.90	25.62	26.53	26.09	26.68
1922	26.04	26.69	26.69	26.83	27.33	27.15	27.23	27.62	28.09	27.71	27.25	27.70	26.78	27.18	26.09	26.88	26.38	26.86	26.48	26.96	26.34	26.63	26.06	26.80
1923	26.17	26.84	26.00	26.95	26.41	27.21	27.22	27.64	27.62	27.70	27.54	27.66	27.03	27.17	27.07	26.85	27.40	26.82	27.52	26.92	27.52	26.57	27.60	26.78
1924	27.04	26.82	27.39	26.94	27.65	27.19	27.75	27.62	27.02	27.67	27.02	27.61	26.25	27.16	26.09	26.80	25.89	26.78	26.28	26.88	25.56	26.53	25.93	26.73
1925	25.55	26.71	26.29	26.86	26.73	27.13	27.25	27.60	27.47	27.64	27.51	27.58	27.73	27.16	27.55	26.81	27.52	26.83	27.58	26.93	27.66	26.65	28.19	26.81
1926	28.10	26.75	28.06	26.94	28.44	27.25	28.78	27.71	28.69	27.72	28.29	27.62	27.86	27.22	27.03	26.85	26.68	26.86	26.34	26.95	26.38	26.78	26.36	26.90
1927	26.68	26.81	27.00	27.03	27.08	27.38	27.50	27.82	27.28	27.80	27.54	27.68	26.92	27.27	26.78	26.92	26.60	26.87	27.00	26.95	26.61	26.84	26.84	26.91
1928	27.05	26.83	26.97	27.06	27.01	27.43	27.55	27.89	27.83	27.80	27.43	27.68	27.25	27.26	26.59	26.91	26.62	26.82	26.61	26.86	26.49	26.75	26.56	26.81
1929	26.43	26.77	26.69	27.02	27.11	27.39	27.62	27.90	27.70	27.81	27.81	27.66	27.21	27.27	26.98	26.87	27.05	26.73	27.13	26.78	26.84	26.71	27.22	26.72
1930	26.93	26.73	27.15	26.95	27.55	27.34	28.18	27.89	27.83	27.82	27.95	27.66	27.86	27.24	27.56	26.87	28.04	26.75	27.87	26.76	28.44	26.72	28.00	26.66
1931	28.07	26.73	28.10	26.93	28.44	27.29	28.73	27.86	28.49	27.77	28.16	27.60	27.63	27.13	27.02	26.81	26.33	26.71	26.51	26.77	26.38	26.69	26.31	26.62
1932	26.16	26.67	26.57	26.89	27.51	27.25	28.02	27.85	28.14	27.73	27.87	27.55	27.11	27.10	26.97	26.78	26.77	26.73	26.75	26.79	26.61	26.72	26.18	26.66
1933	26.36	26.62	26.68	26.89	27.05	27.28	27.78	27.89	27.46	27.72	26.83	27.51	26.56	27.07	25.93	26.75	25.98	26.74	25.63	26.74	25.59	26.70	25.38	26.62
1934	25.64	26.56	25.89	26.85	26.31	27.26	27.35	27.90	27.37	27.70	27.35	27.47	26.80	27.03	26.55	26.72	26.23	26.74	26.48	26.67	26.54	26.68	26.34	26.55
1935	26.26	26.57	26.57	26.86	26.98	27.27	27.45	27.91	27.32	27.72	27.28	27.48	26.58	27.02	26.93	26.76	26.83	26.68	27.01	26.58	26.94	26.64	26.55	26.52
1936	27.32	26.61	27.25	26.91	27.26	27.32	28.06	27.95	27.80	27.77	27.33	27.52	26.88	27.02	26.55	26.76	26.65	26.67	27.12	26.60	26.62	26.65	27.22	26.60
1937	26.27	26.65	27.06	26.94	27.51	27.39	27.98	27.99	27.44	27.79	27.39	27.51	27.32	27.01	26.67	26.74	26.93	26.67	26.63	26.60	26.87	26.65	26.80	26.63
1938	26.37	26.65	26.99	26.92	27.20	27.29	27.86	27.97	27.53	27.77	26.80	27.51	26.24	27.02	26.07	26.74	26.47	26.64	25.98	26.56	25.93	26.61	25.79	26.63
1939	25.91	26.63	25.81	26.92	26.41	27.28	27.50	27.97	27.61	27.80	27.74	27.56	27.48	27.07	26.94	26.80	27.19	26.67	26.27	26.60	26.98	26.63	26.64	26.67
1940	27.76	26.65	28.14	26.96	28.44	27.29	28.57	27.97	28.21	27.84	28.24	27.57	27.43	27.10	27.63	26.77	26.80	26.64	27.06	26.54	27.35	26.58	27.98	26.64
1941	27.95	26.69	28.11	26.91	28.67	27.25	29.13	27.91	29.18	27.83	28.57	27.59	27.95	27.12	27.66	26.72	27.43	26.59	27.72	26.47	27.83	26.54	27.86	26.59
1942	27.19	26.57	27.29	26.85	27.51	27.23	28.34	27.86	27.76	27.81	27.17	27.63	26.67	27.12	25.92	26.70	25.58	26.52	25.41	26.41	25.15	26.48	25.35	26.56
1943	25.38	26.62	25.58	26.84	26.16	27.27	27.17	27.85	27.51	27.83	27.58	27.70	27.13	27.14	26.93	26.73	26.52	26.48	26.29	26.38	26.16	26.46	26.17	26.61
1944	26.15	26.64	26.92	26.90	27.05	27.32	27.88	27.88	28.00	27.87	27.72	27.71	27.30	27.15	26.88	26.75	26.44	26.43	26.51	26.37	26.31	26.39	26.33	26.61
1945	26.22	26.54	26.29	26.82	26.47	27.22	27.01	27.82	27.41	27.80	27.09	27.60	26.62	27.05	26.03	26.66	25.93	26.32	25.87	26.30	26.23	26.21	26.05	26.43
1946	26.14	26.30	26.53	26.57	26.90	27.00	27.29	27.66	27.47	27.65	27.83	27.48	27.26	26.99	26.36	26.60	26.56	26.26	26.73	26.23	26.47	26.08	26.61	26.28
1947	26.97	26.17	26.63	26.45	27.54	26.88	27.70	27.58	27.32	27.56	27.75	27.42	26.83	26.98	26.51	26.63	25.70	26.30	25.92	26.29	25.93	26.12	26.77	26.28
1948	26.63	26.23	27.13	26.51	27.89	26.93	28.02	27.64	28.17	27.58	27.75	27.44	27.16	26.99	26.85	26.66	26.73	26.39	26.06	26.38	26.35	26.22	26.96	26.35
1949	26.12	26.35	27.02	26.58	26.70	27.01	27.96	27.68	27.79	27.59	26.97	27.47	26.84	26.95	26.56	26.60	26.10	26.40	26.01	26.37	25.33	26.22	25.39	26.35
1950	25.53	26.38	25.26	26.57	26.18	27.02	26.86	27.65	26.56	27.51	26.82	27.35	26.14	26.86	26.24	26.54	25.65	26.34	25.90	26.30	25.27	26.11	25.55	26.27

Table 3. HadSST monthly and 10-yma values for the Niño 3.4 region from 1871 to April 2009 (Continued).

Year	January		February		March		April		May		June		July		August		September		October		November		December	
	Mon	10-yma	Mon	10-yma	Mon	10-yma	Mon	10-yma	Mon	10-yma	Mon	10-yma	Mon	10-yma	Mon	10-yma	Mon	10-yma	Mon	10-yma	Mon	10-yma	Mon	10-yma
1951	25.45	26.32	26.02	26.52	26.48	26.99	27.60	27.63	27.77	27.47	27.60	27.27	27.88	26.78	27.77	26.53	27.42	26.28	27.52	26.23	27.44	25.99	27.30	26.19
1952	26.97	26.24	27.00	26.48	27.30	26.95	28.18	27.64	27.48	27.51	27.03	27.25	26.63	26.78	26.45	26.57	26.40	26.32	26.70	26.27	26.33	26.04	26.04	26.21
1953	26.94	26.26	27.00	26.52	27.48	26.96	28.54	27.66	28.21	27.56	28.10	27.28	27.42	26.84	26.91	26.64	27.42	26.38	26.84	26.38	26.96	26.15	26.74	26.26
1954	26.97	26.38	26.98	26.59	27.27	27.02	27.45	27.67	27.34	27.56	26.88	27.31	26.20	26.85	25.80	26.65	25.72	26.38	25.82	26.46	25.49	26.22	25.79	26.31
1955	25.92	26.48	25.98	26.66	26.46	27.11	26.82	27.72	26.64	27.63	26.49	27.37	25.91	26.90	25.96	26.68	25.42	26.44	25.14	26.54	24.75	26.33	25.07	26.42
1956	25.35	26.58	25.79	26.76	26.32	27.19	26.99	27.78	27.28	27.70	26.85	27.41	26.28	26.89	26.06	26.65	25.84	26.44	26.04	26.50	25.64	26.33	26.01	26.42
1957	26.02	26.60	26.52	26.78	27.34	27.20	28.19	27.76	28.31	27.71	28.22	27.44	27.91	26.86	27.66	26.61	27.28	26.37	27.48	26.41	27.74	26.28	27.76	26.38
1958	28.12	26.54	28.16	26.74	28.25	27.17	28.08	27.68	28.19	27.69	27.99	27.45	27.26	26.90	27.12	26.66	26.44	26.35	26.70	26.43	26.71	26.29	26.89	26.42
1959	27.01	26.52	27.26	26.73	27.52	27.15	28.04	27.63	27.85	27.66	27.36	27.43	26.95	26.95	26.47	26.72	26.22	26.36	26.84	26.46	26.48	26.32	26.54	26.45
1960	26.60	26.54	26.52	26.77	27.17	27.16	27.78	27.66	27.92	27.72	27.48	27.51	26.98	27.07	26.87	26.85	26.79	26.49	26.67	26.62	26.27	26.49	26.60	26.59
1961	26.43	26.66	26.80	26.88	27.16	27.27	27.90	27.77	27.86	27.82	27.79	27.64	26.90	27.23	26.62	26.99	26.23	26.67	26.02	26.81	26.46	26.70	26.30	26.75
1962	26.33	26.78	26.60	26.95	26.85	27.33	27.45	27.79	27.45	27.81	27.47	27.66	26.92	27.25	26.74	26.97	26.19	26.65	26.41	26.79	26.22	26.66	26.09	26.69
1963	26.26	26.68	26.50	26.85	27.20	27.22	27.71	27.70	27.86	27.74	27.81	27.62	27.95	27.23	27.78	26.92	27.40	26.62	27.57	26.75	27.40	26.62	27.63	26.64
1964	27.33	26.59	27.31	26.75	27.10	27.15	27.24	27.67	27.13	27.72	26.81	27.64	26.58	27.26	26.11	26.97	25.82	26.68	25.73	26.79	25.55	26.71	25.52	26.70
1965	26.01	26.64	26.41	26.80	26.92	27.18	27.68	27.68	28.05	27.74	28.14	27.67	28.03	27.24	28.12	26.97	28.01	26.69	28.34	26.79	28.20	26.73	28.04	26.68
1966	27.71	26.60	27.59	26.77	28.08	27.14	28.31	27.63	27.81	27.69	27.82	27.62	27.45	27.19	26.77	26.90	26.70	26.64	26.69	26.76	26.28	26.67	26.32	26.59
1967	26.02	26.52	26.20	26.70	26.79	27.09	27.24	27.60	27.63	27.69	27.56	27.62	27.12	27.23	26.57	26.95	26.17	26.72	26.35	26.86	26.32	26.76	26.24	26.70
1968	25.98	26.60	26.02	26.76	26.50	27.12	27.30	27.63	27.43	27.70	27.87	27.61	27.54	27.20	27.20	26.92	26.80	26.70	27.05	26.84	27.42	26.73	27.35	26.67
1969	27.48	26.56	27.79	26.73	27.86	27.09	28.10	27.61	28.25	27.67	27.95	27.57	27.32	27.10	27.39	26.84	27.22	26.63	27.39	26.74	27.40	26.60	27.27	26.52
1970	27.13	26.43	27.12	26.63	27.52	27.02	27.95	27.56	27.87	27.61	27.38	27.49	26.25	27.00	25.92	26.74	25.97	26.52	26.08	26.59	25.81	26.45	25.47	26.38
1971	25.11	26.29	25.48	26.53	25.96	26.93	26.80	27.49	27.04	27.52	26.91	27.40	26.59	26.89	26.22	26.64	26.00	26.42	25.95	26.49	25.80	26.37	25.69	26.27
1972	26.00	26.22	26.55	26.50	27.00	26.90	27.98	27.45	28.19	27.51	28.35	27.42	28.06	26.92	28.18	26.69	27.94	26.50	28.50	26.59	28.53	26.50	28.78	26.38
1973	28.18	26.35	27.84	26.61	27.83	26.98	27.70	27.47	27.30	27.52	26.83	27.41	26.08	26.91	25.66	26.67	25.35	26.52	25.15	26.62	24.58	26.52	24.41	26.42
1974	24.56	26.37	25.26	26.63	25.82	27.00	26.77	27.47	27.07	27.49	26.99	27.37	26.58	26.85	26.56	26.61	26.40	26.49	25.98	26.57	25.70	26.45	25.73	26.39
1975	26.21	26.33	26.43	26.58	26.66	26.96	27.18	27.46	26.87	27.48	26.43	27.39	25.99	26.89	25.72	26.63	25.31	26.52	25.26	26.58	25.19	26.48	24.95	26.46
1976	24.78	26.38	25.71	26.62	26.58	27.02	27.35	27.50	27.37	27.52	27.69	27.46	27.38	26.95	27.18	26.69	27.32	26.59	27.59	26.65	27.54	26.56	27.23	26.58
1977	27.42	26.46	27.31	26.67	27.65	27.10	27.52	27.54	27.84	27.57	28.05	27.50	27.67	26.95	27.13	26.69	27.19	26.63	27.62	26.70	27.69	26.60	27.67	26.64
1978	27.30	26.53	27.27	26.73	27.32	27.16	27.40	27.60	27.37	27.67	27.23	27.59	26.75	26.99	26.26	26.73	26.15	26.69	26.39	26.74	26.50	26.65	26.66	26.71
1979	26.63	26.63	26.86	26.83	27.38	27.27	27.94	27.68	27.77	27.76	27.72	27.65	27.02	27.05	27.09	26.78	27.23	26.73	27.05	26.76	27.00	26.69	27.28	26.73
1980	27.13	26.67	27.09	26.85	27.35	27.30	27.97	27.68	28.00	27.78	28.05	27.67	27.25	27.10	26.65	26.81	26.63	26.77	26.63	26.80	26.75	26.73	26.94	26.76
1981	26.12	26.69	26.31	26.85	27.24	27.29	27.60	27.66	27.76	27.78	27.54	27.69	26.79	27.13	26.70	26.84	26.68	26.82	26.70	26.84	26.39	26.79	26.65	26.84
1982	26.54	26.76	26.64	26.90	27.24	27.34	28.01	27.72	28.51	27.83	28.61	27.73	27.86	27.17	27.80	26.90	28.14	26.87	28.73	26.87	28.72	26.81	28.92	26.85
1983	29.01	26.77	28.98	26.92	28.95	27.39	28.89	27.77	28.99	27.85	28.31	27.72	27.11	27.16	26.75	26.92	26.26	26.89	25.70	26.81	25.52	26.72	25.64	26.75
1984	25.78	26.67	26.23	26.84	26.78	27.33	27.17	27.70	27.22	27.78	26.79	27.64	26.82	27.10	26.47	26.83	26.40	26.81	25.90	26.68	25.48	26.59	25.05	26.61
1985	25.69	26.55	25.85	26.77	26.30	27.26	26.79	27.64	26.97	27.76	26.93	27.59	26.62	27.09	26.38	26.81	26.18	26.78	26.09	26.66	26.22	26.56	26.19	26.56
1986	25.79	26.57	26.12	26.81	26.75	27.28	27.36	27.66	27.39	27.80	27.61	27.61	27.38	27.15	27.11	26.86	27.34	26.81	27.63	26.72	27.70	26.62	27.56	26.64
1987	27.77	26.70	27.94	26.93	28.50	27.36	28.66	27.74	28.77	27.85	28.92	27.63	28.56	27.18	28.36	26.94	28.28	26.75	28.10	26.65	27.94	26.58	27.64	26.60
1988	27.27	26.67	27.11	26.93	27.54	27.37	27.28	27.79	26.82	27.87	26.23	27.61	25.69	27.19	25.43	26.80	25.42	26.71	24.65	26.60	24.48	26.54	24.60	26.54
1989	24.63	26.61	25.39	26.86	25.93	27.33	26.66	27.81	27.06	27.90	27.04	27.67	26.76	27.24	26.29	26.86	26.37	26.78	26.33	26.75	26.36	26.73	26.46	26.74
1990	26.60	26.75	27.12	26.97	27.46	27.42	28.03	27.90	28.19	27.99	27.69	27.77	27.37	27.30	27.05	26.92	26.87	26.82	26.86	26.84	26.73	26.83	26.90	26.86

Table 3. HadSST monthly and 10-yma values for the Niño 3.4 region from 1871 to April 2009 (Continued).

Year	January		February		March		April		May		June		July		August		September		October		November		December	
	Mon	10-yma	Mon	10-yma	Mon	10-yma	Mon	10-yma	Mon	10-yma	Mon	10-yma	Mon	10-yma	Mon	10-yma	Mon	10-yma	Mon	10-yma	Mon	10-yma	Mon	10-yma
1991	27.09	26.86	27.08	27.06	27.36	27.50	27.98	27.97	28.30	28.04	28.34	27.81	27.84	27.31	27.30	26.89	26.98	26.77	27.64	26.77	27.79	26.74	28.20	26.77
1992	28.19	26.78	28.39	26.98	28.76	27.43	29.18	27.95	29.13	28.04	28.22	27.80	27.50	27.31	26.73	26.89	26.61	26.76	26.39	26.76	26.51	26.73	26.63	26.76
1993	26.86	26.79	27.18	27.00	27.73	27.43	28.68	27.99	28.79	28.12	28.33	27.85	27.55	27.37	27.04	26.94	27.01	26.81	27.09	26.85	26.94	26.84	26.77	26.85
1994	26.61	26.90	26.60	27.09	27.19	27.51	27.80	28.07	28.00	28.21	27.96	27.89	27.38	27.39	27.40	26.95	27.15	26.81	27.63	26.87	27.79	26.83	27.80	26.80
1995	27.68	26.83	27.64	26.99	27.75	27.46	28.04	28.04	27.89	28.15	27.77	27.84	27.26	27.33	26.50	26.91	26.18	26.76	26.01	26.80	25.87	26.73	25.86	26.67
1996	25.93	26.67	26.10	26.85	26.78	27.36	27.43	27.96	27.46	28.06	27.57	27.76	27.08	27.27	26.58	26.86	26.41	26.71	26.46	26.71	26.35	26.62	26.16	26.51
1997	26.15	26.51	26.53	26.72	27.19	27.26	28.11	27.87	28.74	27.97	28.84	27.73	28.83	27.25	28.81	26.87	28.85	26.74	29.02	26.72	29.08	26.63	28.89	26.47
1998	29.00	26.46	28.84	26.65	28.75	27.19	28.67	27.76	28.55	27.84	27.30	27.70	26.49	27.26	26.04	26.91	25.93	26.78	25.54	26.80	25.43	26.71	25.08	26.55
1999	25.05	26.50	25.35	26.67	26.34	27.19	26.96	27.71	26.99	27.77	26.74	27.65	26.39	27.26	25.89	26.91	25.91	26.79	25.70	26.80	25.24	26.69	25.04	26.53
2000	24.79	26.49	25.23	26.66	26.00	27.17	26.97	27.71	27.07	27.78	26.93	27.65	26.65	27.27	26.52	26.93	26.36	26.82	26.18	26.82	25.91	26.68	25.67	26.50
2001	25.70	26.44	26.13	26.63	26.78	27.15	27.47	27.72	27.57	27.81	27.58	27.67	27.24	27.28	26.80	26.98	26.47	26.90	26.47	26.90	26.37	26.76	26.13	26.58
2002	26.44	26.48	26.76	26.64	27.36	27.14	27.91	27.69	28.07	27.76	28.37	27.61	27.80	27.19	27.57	26.89	27.57	26.79	27.89	26.77	28.06	26.63	28.00	26.46
2003	27.56	26.32	27.40	26.47	27.74	27.00	27.74	27.58	27.34	27.63	27.50	27.54	27.37	27.13	26.92	26.81	26.90	26.66	27.19	26.63	27.05	26.47	26.91	26.29
2004	26.84	26.32	26.93	26.32	27.16	26.88	27.83	27.52	27.96	-	27.82	-	27.64	-	27.54	-	27.42	-	27.46	-	27.27	-	27.30	-
2005	27.14	-	27.02	-	27.54	-	28.05	-	28.16	-	27.91	-	27.22	-	26.83	-	26.67	-	26.59	-	26.21	-	25.83	-
2006	25.60	-	26.05	-	26.53	-	27.47	-	27.76	-	27.78	-	27.25	-	27.25	-	27.38	-	27.49	-	27.64	-	27.69	-
2007	27.17	-	26.88	-	27.11	-	27.61	-	27.47	-	27.52	-	26.86	-	26.31	-	25.71	-	25.33	-	25.07	-	24.98	-
2008	24.79	-	25.07	-	26.09	-	26.88	-	27.22	-	27.24	-	27.19	-	26.83	-	26.47	-	26.43	-	26.29	-	25.69	-
2009	25.58	-	26.05	-	26.54	-	27.52	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
1871–2008 Statistics:																								
Mean	26.54	-	26.72	-	27.13	-	27.64	-	27.69	-	27.56	-	27.07	-	26.76	-	26.62	-	26.63	-	26.53	-	26.54	-
sd	0.95	-	0.83	-	0.70	-	0.58	-	0.57	-	0.55	-	0.60	-	0.66	-	0.72	-	0.84	-	0.95	-	0.97	-
High	29.01	-	29.19	-	28.95	-	29.18	-	29.18	-	28.92	-	28.83	-	28.81	-	28.85	-	29.02	-	29.08	-	29.07	-
Low	24.09	-	24.65	-	25.82	-	26.47	-	26.46	-	26.23	-	25.69	-	25.39	-	25.31	-	24.65	-	24.48	-	24.41	-
medium	26.365	-	26.655	-	27.155	-	27.61	-	27.685	-	27.54	-	27.08	-	26.72	-	26.58	-	26.51	-	26.385	-	26.40	-
CV	0.036	-	0.031	-	0.026	-	0.021	-	0.021	-	0.020	-	0.022	-	0.025	-	0.027	-	0.032	-	0.036	-	0.037	-
PCS	0.55	-	0.23	-	-0.11	-	0.16	-	0.03	-	0.11	-	-0.05	-	0.18	-	0.17	-	0.14	-	0.46	-	0.43	-
na	69	-	69	-	69	-	70	-	69	-	70	-	70	-	69	-	70	-	70	-	69	-	69	-
nb	69	-	69	-	69	-	68	-	69	-	68	-	68	-	69	-	68	-	68	-	69	-	69	-
nra	29	-	34	-	29	-	30	-	33	-	29	-	30	-	33	-	32	-	33	-	34	-	32	-
z	-2.04	-	-0.34	-	-2.04	-	-1.70	-	-0.68	-	-2.04	-	-1.70	-	-0.68	-	-1.02	-	-0.68	-	-0.34	-	-1.02	-
random	no	-	yes	-	no	-	no	-	yes	-	no	-	no	-	yes	-	yes	-	yes	-	yes	-	yes	-
±50%	0.64	-	0.56	-	0.47	-	0.39	-	0.39	-	0.37	-	0.41	-	0.45	-	0.49	-	0.57	-	0.64	-	0.66	-

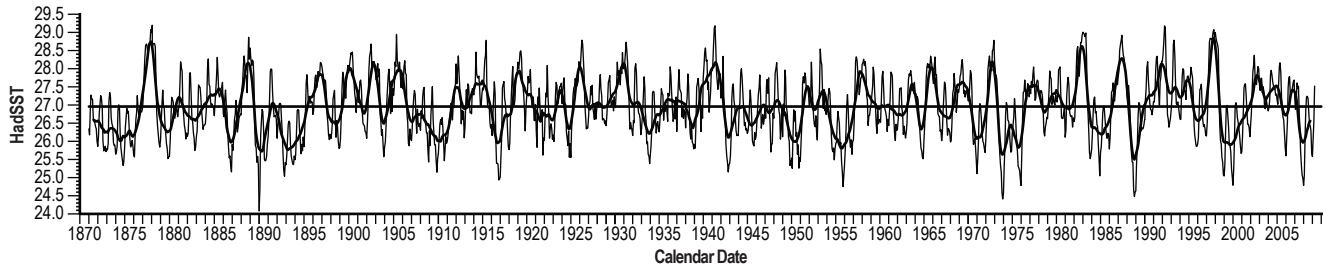


Figure 15. Monthly and 12-mma values of nonseasonally adjusted HadSST values from January 1871 to January 2010.

### 2.3 2-mma Values of Seasonally Adjusted Monthly Means of HadSST (D(m2)) and SOI (SOI(2)) in the Niño 3.4 Region (1871–2008)

Figure 16 depicts the 2-mma values of the seasonally adjusted monthly means of HadSST (D(m2)), where the shaded portions represent anomalous ENSO extreme events. The seasonally adjusted values were determined by subtracting the long-term monthly averages from the observed HadSST monthly values, then performing a 2-mma of the differences, with determination of anomalous HadSST ENSO extremes (based on D(m2) values) following that used in the determination of ONI anomalous ENSO extreme events (see section 1).

From figure 16, some 33 EN and 27 LN events are identified. For convenience, the listing of EN and LN events is given in table 4, identifying the start, peak, and end dates (by year-month); the duration of each event (in months); the event type (EN or LN); the strength of each event, both in terms of class strength (i.e., W, M, and S) and peak anomalous temperature in degrees Celsius; and comments, where SP means single peak, DP means double peak, and MP means multiple peaks (three or more).

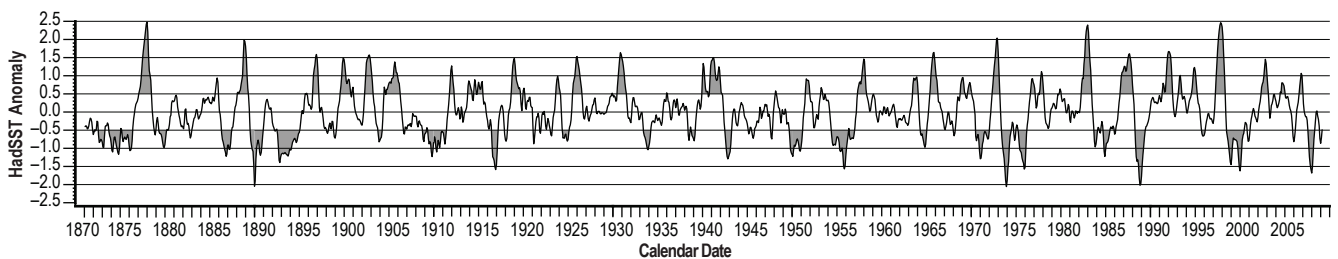


Figure 16. Monthly and 2-mma values of the seasonally adjusted values of HadSST anomaly (D(m2)) from February 1871 to January 2010, where shaded portions reflect occurrences of warm EN events (positive anomalies) and cold LN events (negative anomalies), respectively.

Table 4. Listing of EN and LN events based on the HadSST dataset from 1871 to 2008.

Start	Peak	End	Duration (mo)	Type	Strength (degrees)	Comment
1872-08	1873-02	1873-04	9	LN	W(−0.97)	SP
1873-10	1874-11	1875-01	16	LN	M(−1.16)	SP
1875-03	1876-02	1876-05	15	LN	M(−1.06)	MP
1877-02	1878-01	1878-06	17	EN	VS(+2.48)*	SP
1879-05	1879-12	1880-03	11	LN	W(−0.98)	SP
1886-05	1887-03/04	1887-06	14	LN	M(−1.03)	DP
1888-02	1888-11	1889-04	15	EN	S(+1.98)	DP
1889-08	1890-01	1890-12	17	LN	VS(−2.04)*	DP
1892-08	1892-11	1895-01	30	LN	M(−1.39)	MP
1896-07	1896-12	1897-03	9	EN	S(+1.59)	SP
1899-08	1899-12	1900-10	15	EN	M(+1.49)	DP
1902-05	1902-11	1903-04	12	EN	S(+1.57)	SP
1903-11	1903-12	1904-04	6	LN	W(−0.82)	SP
1904-10	1905-09	1906-04	19	EN	M(+1.38)	DP
1908-11	1908-12	1909-03	5	LN	W(−0.81)	SP
1909-06	1909-11	1911-05	24	LN	M(−1.23)	MP
1911-11	1912-01	1912-04	6	EN	M(+1.27)	SP
1913-11	1913-12	1914-04	6	EN	W(+0.86)	SP
1914-12	1915-06	1915-06	7	EN	W(+0.84)	DP
1916-07	1916-12	1917-03	9	LN	S(−1.58)	SP
1918-09	1919-01	1919-09	13	EN	M(+1.48)	DP
1923-09	1923-11	1924-02	6	EN	W(+0.98)	SP
1924-06	1924-12	1925-02	9	LN	W(−0.80)	DP
1925-07	1926-01	1926-07	13	EN	S(+1.53)	SP
1930-07	1930-11	1931-07	13	EN	S(+1.63)	SP
1933-06	1933-12	1934-03	10	LN	M(−1.04)	SP
1938-10	1939-02	1939-03	6	LN	W(−0.79)	SP
1940-01	1940-02	1940-08	8	EN	M(+1.34)	DP
1940-11	1941-04	1942-03	17	EN	S(+1.50)	DP
1942-07	1942-11	1943-04	10	LN	M(−1.29)	SP
1949-10	1950-02	1951-03	18	LN	M(−1.22)	MP
1951-07	1951-08	1951-12	6	EN	W(+0.91)	SP
1954-06	1955-11	1956-12	31	LN	S(−1.56)	MP
1957-05	1958-01	1958-04	12	EN	M(+1.46)	DP
1963-07	1963-12	1964-01	7	EN	W(+0.96)	DP
1964-05	1964-11	1965-01	9	LN	W(−0.97)	DP
1965-06	1965-11	1966-04	11	EN	S(+1.64)	SP
1968-11	1969-02	1969-04	6	EN	W(+0.95)	SP
1969-08	1969-11	1970-01	6	EN	W(+0.81)	SP
1970-07	1971-01	1972-01	19	LN	M(−1.29)	MP
1972-05	1972-11/12	1973-03	11	EN	VS(+2.03)*	SP
1973-06	1973-12	1974-06	13	LN	VS(−2.05)*	SP
1975-04	1975-12	1976-03	12	LN	S(−1.57)	SP
1976-09	1976-11	1977-02	6	EN	W(+0.92)	SP
1977-09	1977-11	1978-01	6	EN	M(+1.11)	SP
1982-05	1983-01	1983-06	14	EN	VS(+2.40)*	DP



Table 4. Listing of EN and LN events based on the HadSST dataset from 1871 to 2008 (Continued).

Start	Peak	End	Duration (mo)	Type	Strength (degrees)	Comment
1983-10	1983-11	1984-02	5	LN	W(−0.96)	SP
1984-10	1984-12	1985-06	9	LN	M(−1.22)	SP
1986-09	1987-09	1988-01	17	EN	S(+1.60)	DP
1988-05	1988-11	1989-06	14	LN	VS(−2.01)*	DP
1991-05	1992-01/02	1992-06	14	EN	S(+1.66)	DP
1993-03	1993-05	1993-07	5	EN	M(+1.00)	SP
1994-08	1994-12	1995-03	8	EN	M(+1.23)	SP
1995-10	1995-11/12	1996-02	5	LN	W(−0.66)	SP
1997-04	1997-11	1998-05	14	EN	VS(+2.46)*	SP
1998-07	2000-01	2000-06	24	LN	S(−1.62)	DP
2002-06	2002-11	2003-03	10	EN	M(+1.45)	SP
2004-07	2004-09/10	2005-01	7	EN	W(+0.80)	SP
2006-09	2006-11	2007-01	5	EN	M(+1.06)	SP
2007-08	2008-01	2008-05	10	LN	S(−1.68)	SP

Notes \* VS = very strong events are those where the anomaly exceeds the  $\pm 2$  degree threshold.

SP = single peak.

DP = double peak.

MP = multiple peaks (three or more).

Of the 33 EN events, 9 are considered W, 11 are M, and 13 are S or very strong (VS) in strength. The greatest positive anomalies (EN events classified as VS) occurred in January 1877 (+2.48 °C), November/December 1972 (+2.03 °C), January 1983 (+2.40 °C), and November 1997 (+2.46 °C). The longest duration EN event was 19 months in length, occurring between October 1904 and April 1906. The average duration ( $\pm 1$  *sd*) of EN events is  $10.3 \pm 4.2$  months. Twenty-one of 33 EN events were single peaked, 12 were double peaked, and none had 3 or more peaks.

Of the 27 LN events, 9 are considered W, 10 are M, and 8 are S or VS. The greatest negative anomalies (LNs classified as VS) occurred in January 1890 (−2.04 °C), December 1973 (−2.05 °C), and November 1988 (−2.01 °C). The longest duration LN event was 31 months in length, occurring between June 1954 and December 1956. The average duration of LN events is  $13.3 \pm 7.2$  months. Fifteen of 27 LN events were single peaked, 6 were double peaked, and 6 had multiple peaks.

Table 5 shows the frequency of occurrence of EN and LN event starts, peaks, and ends for selected monthly intervals. Hence, half (30 of 60 events) of all EN and LN events have onset during the interval July to October, nearly all peak (52 of 60 events) during the interval November to February, and slightly more than half (36 of 60 events) end during the interval of March to June.

Table 5. Frequency of occurrence of start, peak, and end times for HadSST-determined EN and LN events.

Monthly Interval	EN(33)			LN(27)		
	Start	Peak	End	Start	Peak	End
November–February	8	26	9	2	26	9
March–June	9	3	18	11	1	18
July–October	16	4	6	14	0	0

Figure 17 displays the 2-mma values of the SOI (SOI(2)) for the interval 1871–present. Recall that extended intervals of positive SOI reflect LN-like conditions while extended intervals of negative SOI reflect EN-like conditions. Comparison of the 2-mma of SOI(2) (fig. 17) against D(m2) (fig. 16) reveals a strong negative correlation between the two parameters, having  $r = -0.84$ , based on the interval 1971–2000 (the base period used in determination of the ONI), although, plainly, SOI(2) sometimes leads and sometimes lags D(m2). The overall negative correlation weakens if one uses the entire interval 1871–2008, suggesting, perhaps, that the early occurring values, in particular, of D(m2) (and hence, HadSST) might not be as reliable as compared to later occurring values. The strongest negative anomalies (usually associated with EN events) occurred in August 1882 (–21.8), May/June 1896 (–31.0), April 1905 (–38.2), February 1983 (–31.3), May 1987 (–21.9), and March 1998 (–25.2). The strongest positive anomalies (usually associated with LN events) occurred in December 1872 (27.9), August 1879 (21.5), December 1889 (22.0), April 1904 (20.5), August 1917 (31.9), June 1950 (20.6), November 1973 (22.5), and August 1975 (21.3).

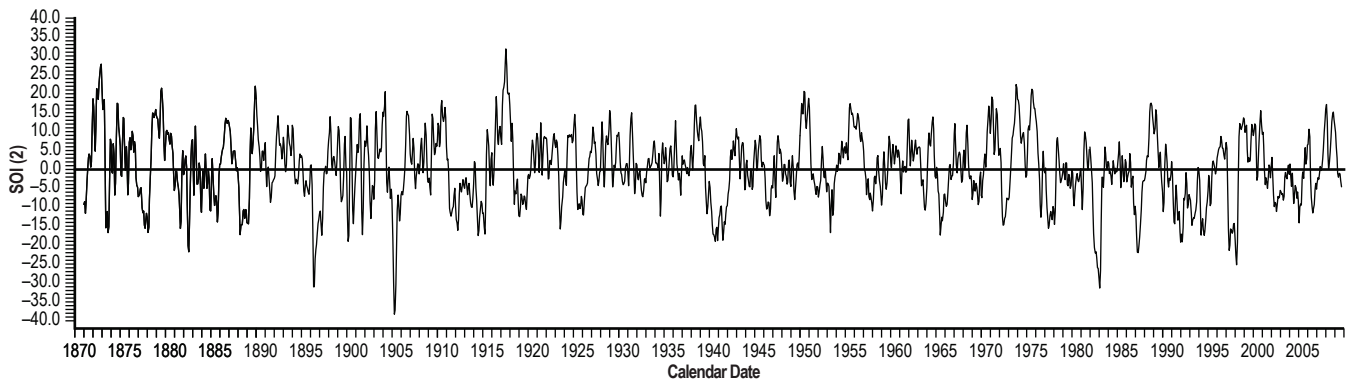


Figure 17. Presentation of 2-mma values of SOI (SOI(2)) anomaly from January 1871 to January 2010.

Figures 18 and 19, respectively, depict the results of epoch analyses for the 33 EN and 27 LN events catalogued in table 4 in terms of D(m2) (upper panels) and SOI(2) (lower panels) and strength, where 1 represents W events, 2 M events, and 3 S and VS events. As expected, S events are more likely to have a later-occurring peak and a longer duration than events of lesser strength (true using D(m2) or SOI(2)).

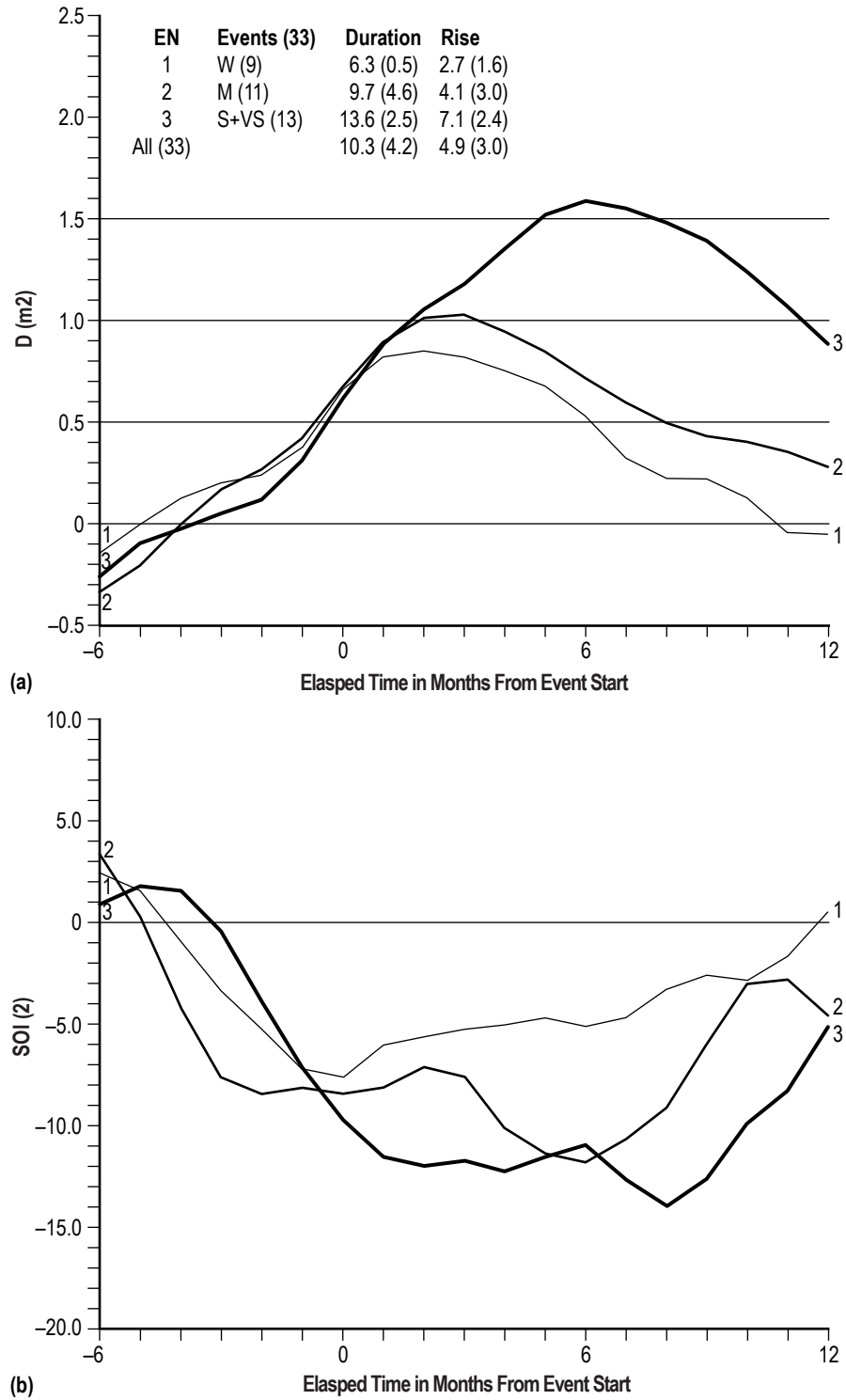


Figure 18. Results of epoch analysis for EN events, (a) D(m2) and (b) SOI(2).

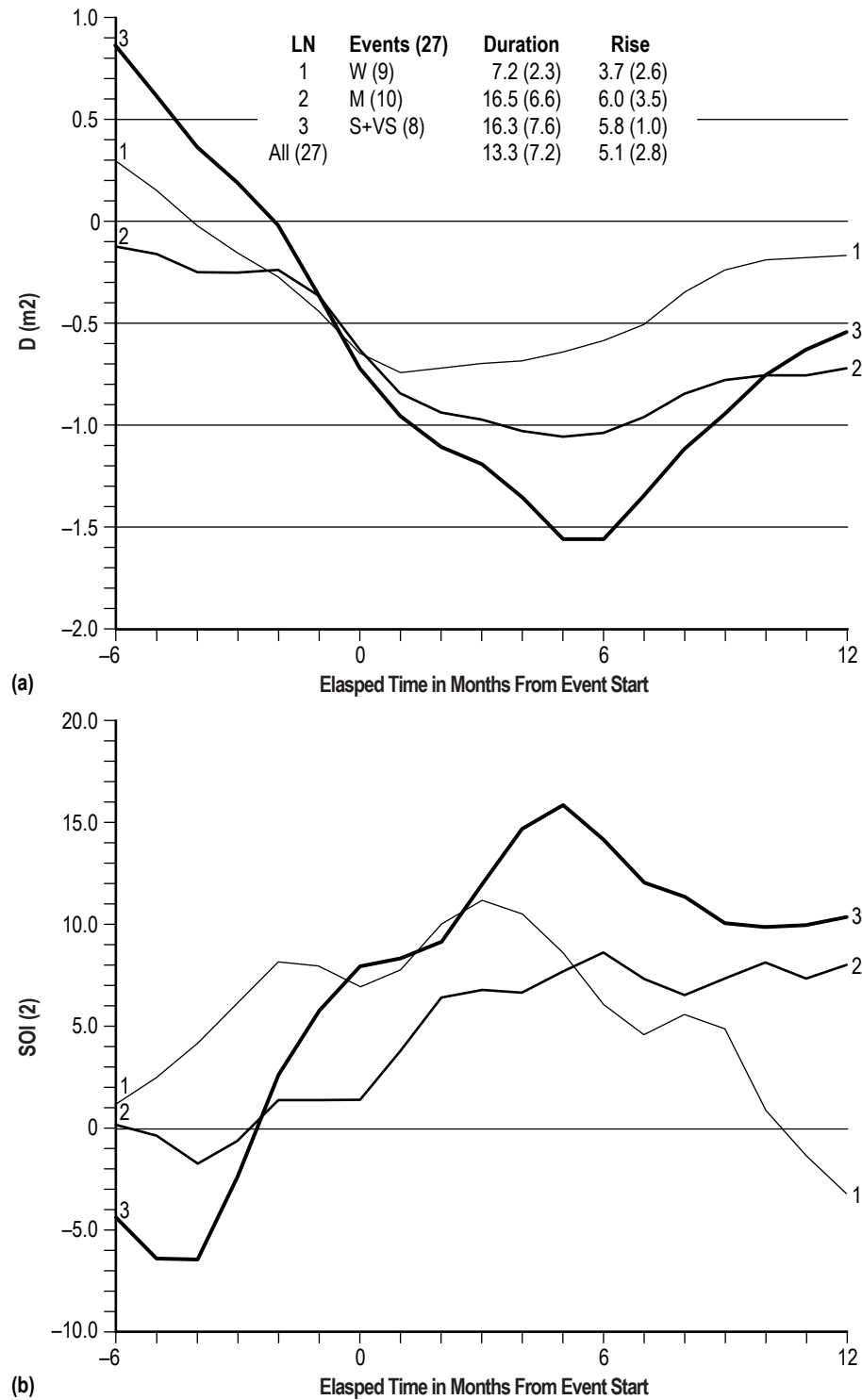


Figure 19. Results of epoch analysis for LN events, (a) D(m2) and (b) SOI(2).

## 2.4 The ONI Values in the Niño 3.4 Region (1950–2008)

Figure 20 displays the ONI values for the interval 1950–present, plotted akin to that employed in figure 16 for  $D(m2)$ . Again, the shaded portions of the figure denote the occurrences of the extremes of the ENSO cycle, where positive anomalies represent EN events and negative anomalies represent LN events. From figure 20, one can identify 31 extreme events, consisting of 18 EN and 13 LN events (since 1950). Recall from figure 16 that, for the same time interval (i.e., since January 1950), one can identify 30 extreme events using  $D(m2)$ , as well, consisting of 18 EN events and 12 LN events, with the most recent 2009 EN event not included in figure 16. Hence, there appears generally good agreement in identifying the occurrences and strengths of the extremes using the two datasets. While true, some subtle differences are found. For example, in figure 16, the  $D(m2)$  LN event of 1973 began in June 1973 and ended in June 1974 with another separate LN event following in April 1975 that ended in March 1976. In figure 20, the ONI records the 1973 LN event as starting in May 1973 and being one long continuous event that ended in May 1976. Another difference is the inclusion of an LN event in 1983 in figure 16 but not included in figure 20, the inclusion of an EN event in 1993 in figure 16 but not included in figure 20, and the inclusion of a LN event in 2000 in figure 20 but not in figure 16. For the ONI-identified extremes, LN and EN events are found to average, respectively, about 15.0 and 10.1 months in duration, while for the same interval, the  $D(m2)$ -identified extremes of LN and EN events are found to average, respectively, about 13.7 and 9.2 months in duration. It appears then that extremes identified using the ONI values tend to be slightly longer in duration than when identified using  $D(m2)$ . For convenience, table 6 is included, giving the event start, peak, and end times; duration; type; strength; and comments for the ONI-determined EN and LN events, constructed similar to that of table 4, which identified extremes using  $D(m2)$ .

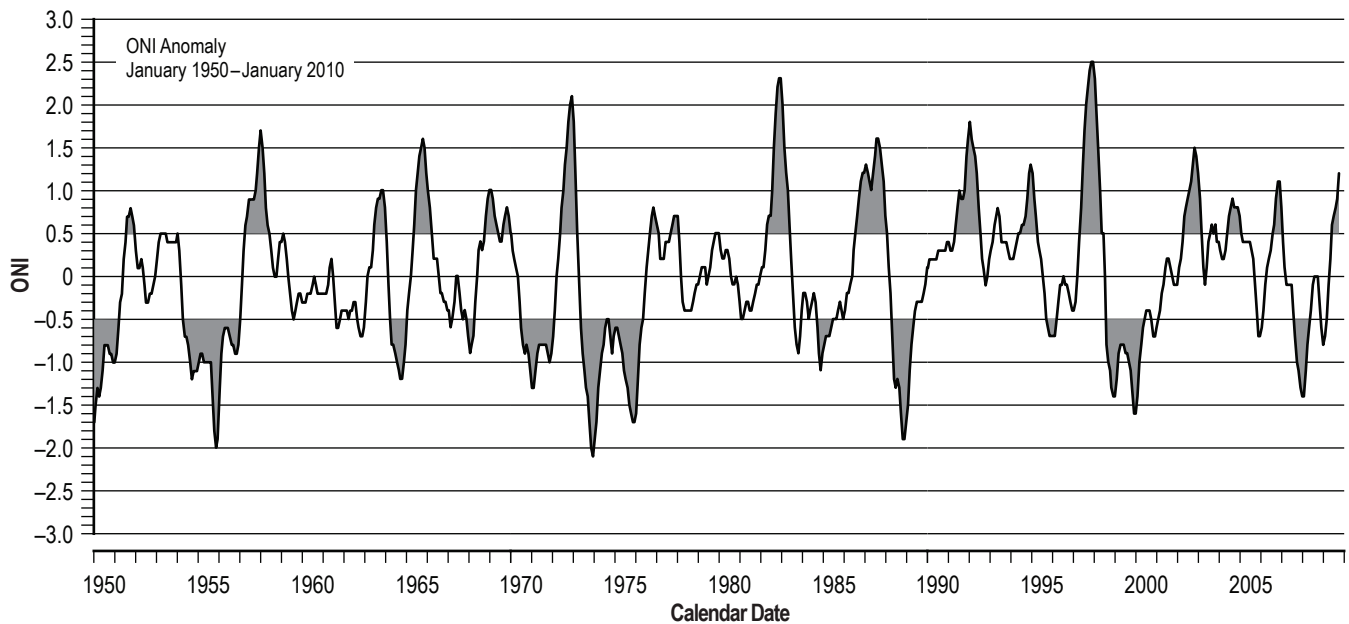


Figure 20. The ONI anomalies from January 1950 to January 2010, where shaded portions reflect occurrences of warm EN events (positive anomalies) and cold LN events (negative anomalies), respectively.

Table 6. Listing of EN and LN events based on ONI (ERSST.v3b).

Start	Peak	End	Duration (mo)	Type	Strength (degrees)	Comments
B01-1950	01-1950(?)	03-1951	>15(?)	LN	S(−1.7)?	MP
08-1951	10-1951	12-1951	5	EN	W(+0.8)	SP
04-1954	11-1955	01-1957	34	LN	S(−2.0)	MP
04-1957	01-1958	06-1958	15	EN	S(+1.7)	SP
09-1962	11-1962	01-1963	5	LN	W(−0.7)	SP
07-1963	11-1963	01-1964	7	EN	M(+1.0)	SP
04-1964	10-1964	01-1965	10	LN	M(−1.2)	SP
06-1965	11-1965	04-1966	11	EN	S(+1.6)	SP
12-1967	02-1968	04-1968	5	LN	W(−0.9)	SP
11-1968	01-1969	06-1969	8	EN	M(+1.0)	SP
09-1969	11-1969	01-1970	5	EN	W(+0.8)	SP
07-1970	01-1971	01-1972	19	LN	M(−1.3)	MP
05-1972	12-1972	03-1973	11	EN	S(+2.1)	SP
05-1973	12-1973	05-1976	37	LN	S(−2.1)	MP
09-1976	11-1976	02-1977	6	EN	W(+0.8)	SP
09-1977	11-1977	01-1978	5	EN	W(+0.7)	SP
05-1982	12-1982	06-1983	14	EN	S(+2.3)	SP
10-1984	12-1984	09-1985	12	LN	M(−1.1)	SP
08-1986	08-1987	02-1988	19	EN	S(+1.6)	DP
05-1988	11-1988	05-1989	13	LN	S(−1.9)	DP
05-1991	01-1992	07-1992	15	EN	S(+1.8)	DP
05-1994	12-1994	03-1995	11	EN	M(+1.3)	SP
09-1995	11-1995	03-1996	7	LN	W(−0.7)	SP
05-1997	11-1997	05-1998	13	EN	S(+2.5)	SP
07-1998	12-1999	06-2000	24	LN	S(−1.6)	DP
10-2000	12-2000	02-2001	5	LN	W(−0.7)	SP
05-2002	11-2002	03-2003	11	EN	S(+1.5)	SP
06-2004	09-2004	02-2005	9	EN	W(+0.5)	SP
08-2006	11-2006	01-2007	6	EN	M(+1.1)	SP
09-2007	01-2008	05-2008	9	LN	M(−1.4)	SP
06-2009	12-2009	–	>8	EN	S(+1.8)	SP(?)
Averages:			EN	10.1 <sup>#</sup>		
			LN	15.0 <sup>@</sup>		

Notes: B means before.

? means uncertain.

# means excluding the 2009 EN event.

@ means excluding the 1950 LN event.

Correlation analysis of ONI and D(m2) during the ONI base period of 1971–2000 shows that the two parameters are highly correlated, having  $r = 0.99$ . The inferred regression equation between ONI and D(m2) using ONI as the independent variable is  $D(m2) = -0.047 + 0.991\text{ONI}$  ( $se = 0.130\text{ }^{\circ}\text{C}$ ) and the inferred regression equation between ONI and D(m2) using D(m2) as the independent variable is  $\text{ONI} = 0.048 + 0.989D(m2)$  ( $se = 0.130\text{ }^{\circ}\text{C}$ ).

## 2.5. The Duration-Maximum Anomaly Association for ENSO Extreme Events

Figure 21 shows the scatter plots of (a) the duration of EN and LN events against their maximum anomalous excursion temperature using ONI (max ONI) for the interval 1950–2008 and (b) the duration of EN and LN events against their maximum anomalous excursion temperatures

using  $D(m2)$  (max  $D(m2)$ ) for the interval 1871–2008. In both panels, the larger filled circles represent two events, both having the same duration and maximum anomaly excursion temperature. In figure 21, one finds the association between the duration of an ENSO extreme event (i.e., EN and LN events) and the maximum anomalous excursion to be statistically important. Hence, knowing the maximum value of the anomaly, one can estimate the duration of the event (at least its minimum length). For example, an EN event having  $\max \text{ONI} \geq 1.3^\circ\text{C}$  has always had a duration  $\geq 11$  months; whereas, an EN event having  $\max \text{ONI} < 1.3^\circ\text{C}$  has always had a duration  $< 11$  months. The 2009 EN event, having had a  $\max \text{ONI} = 1.8^\circ\text{C}$ , therefore is not expected to end until May 2010 or later, based on the inferred preferential association. Based on  $D(m2)$ , an EN event having  $\max D(m2) \geq 1.45^\circ\text{C}$  has always had a duration  $\geq 9$  months; whereas, an EN event having  $\max D(m2) < 1.45^\circ\text{C}$  almost always has had duration  $< 9$  months. For a LN event having  $\max \text{ONI}$  ( $\max D(m2)$ ) equal to  $-1.25^\circ\text{C}$  ( $-1.23^\circ\text{C}$ ) or cooler, one expects a duration of 13 months (11 months) or longer; whereas, for a LN event having  $\max \text{ONI}$  ( $\max D(m2)$ ) equal to  $-1.2^\circ\text{C}$  ( $-1.22^\circ\text{C}$ ) or warmer, one expects a duration of 12 months (10 months) or shorter.

It is apparent from figure 21 that LN events tend to be longer in duration than EN events, sometimes extending about 3 years in duration. El Niño events appear to have never extended longer than about a year-and-a-half in duration.

## 2.6. Recurrence Periods of the ENSO Extremes

Figure 22 depicts (a) RP against duration for the EN events (1950–2008) using  $D(m2)$ , (b) RP against duration for the LN events (1950–2008) using  $D(m2)$ , (c) RP against duration for the EN events (1950–2009) using ONI, and (d) RP against duration for the LN events (1950–2009) using ONI. For each panel, the thin vertical and horizontal lines represent the medians of the parameters, and the symbols refer to S or VS events (filled triangles), M events (filled squares), and W events (filled circles). Also, for each panel, the Fisher's exact test for  $2 \times 2$  contingency tables is applied. Figure 21c shows that there is a statistically significant association between RP and the duration for EN events during the interval 1950–2009 when based on ONI, one having  $P = 1.3\%$ , meaning that the probability of obtaining the observed distribution, or one more suggestive of a departure from independence, is computed to be  $P = 1.3\%$ . Using  $D(m2)$  (fig. 21a), however, one computes  $P = 23.8\%$ , inferring a statistically unimportant association. For LN events (figs. 21b and c), neither descriptor appears to be statistically important.

Figure 23 plots RP against duration for (a) EN and (b) LN events for the expanded interval 1871–2008 using  $D(m2)$ . For EN events, the distribution of RP against duration now has  $P = 0.1\%$ , inferring a highly statistically important association. Also, for EN events, linear regression analysis suggests that RP is highly statistically related to duration, having  $r = 0.68$  ( $se = 25.1$  months). Thus, as duration for an EN event increases, there is a strong tendency for the RP to increase such that those EN events having duration of 11 months or more usually have an  $RP \geq 39$  months (true for 13 of 16 EN events), and those having durations 10 months or less usually have an  $RP < 39$  months (true for 13 of 16 EN events). For LN events,  $P = 50.0\%$ , inferring that the distribution results from chance. (In figure 22a, the large filled triangle at duration equal to 13 months and RP equal to 60 months is really two EN events, one of S and one of M strength.)

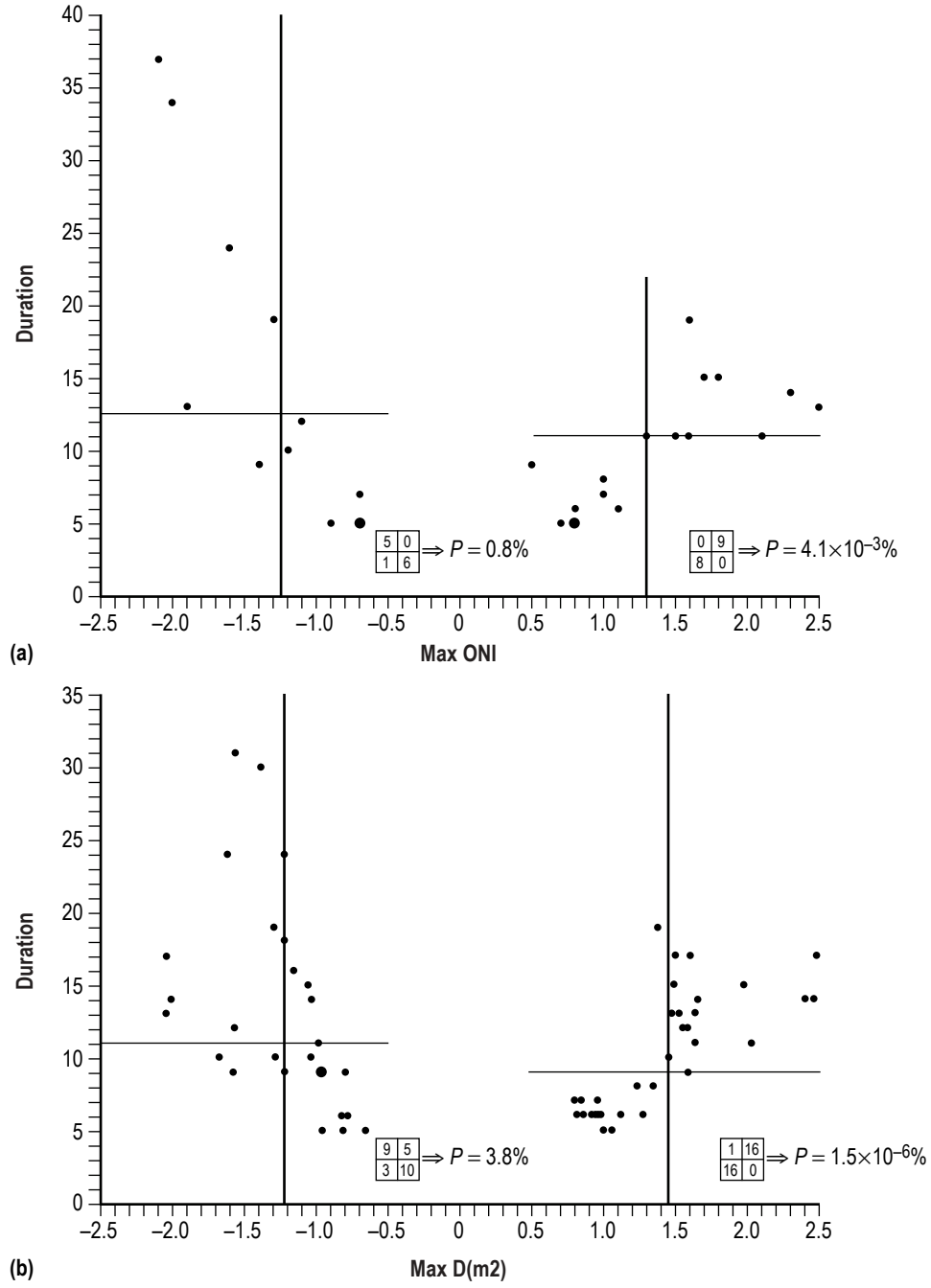


Figure 21. Duration against (a) max ONI for LN and EN events (1950 – 2008) and (b) max D(m2) for LN and EN events (1871 – 2008).



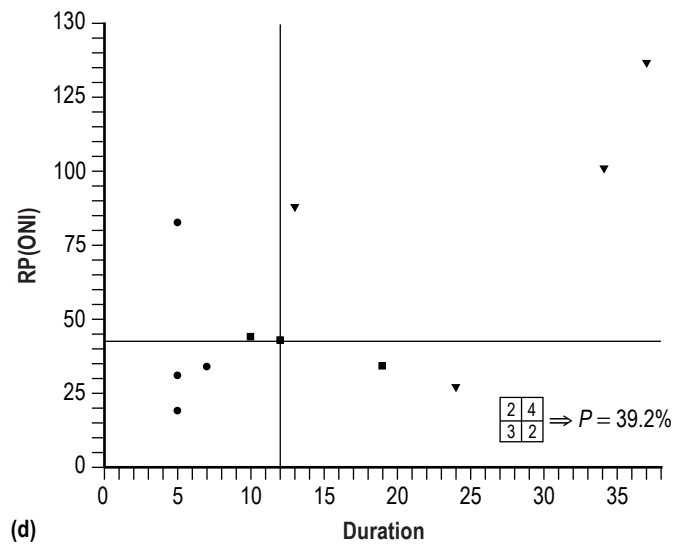
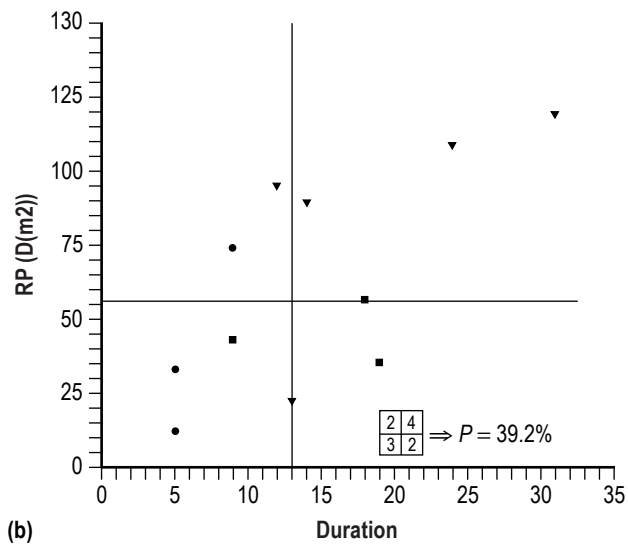
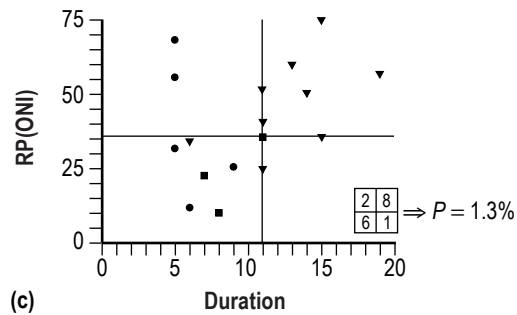
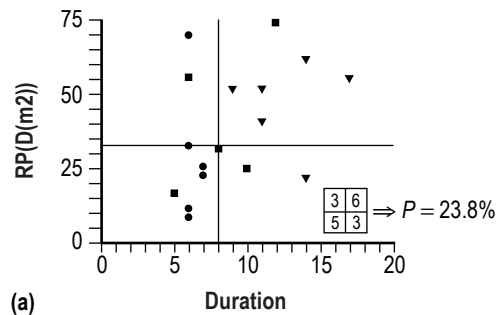


Figure 22. RP-duration distributions for (a) EN events (1950–2008) based on D(m2), (b) LN events (1950–2008) based on D(m2), (c) EN events (2000–2009) based on ONI, and (d) LN events (2000–2009) based on ONI.

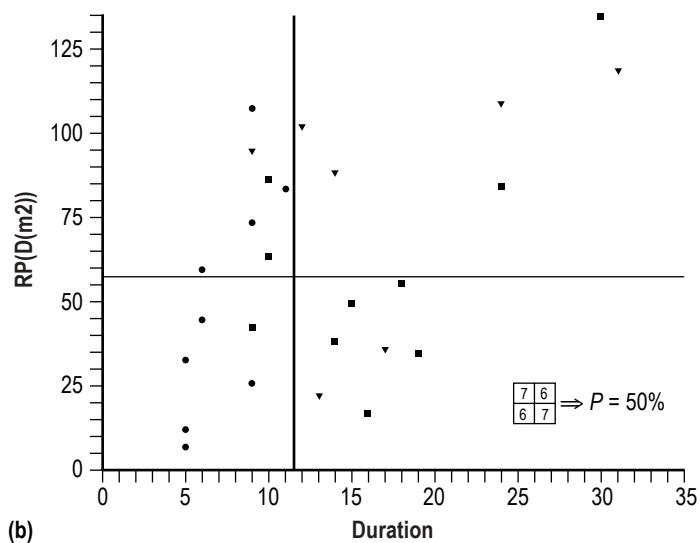
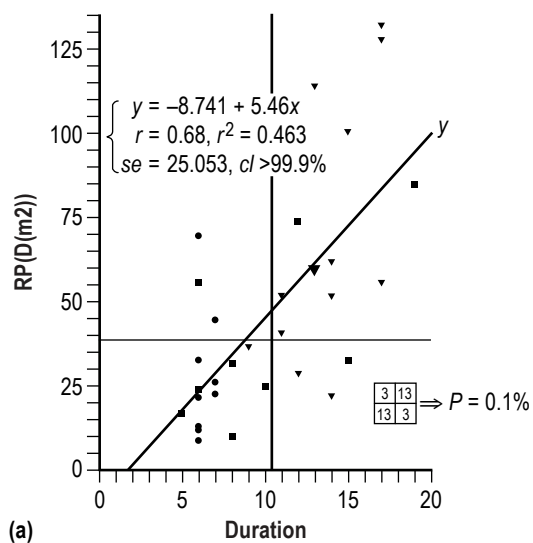


Figure 23. RP-duration distribution for (a) EN events (1871–2008) based on D(m2) and (b) LN events (1871–2008) based on D(m2).

## 2.7 Decadal Aspects of ENSO Extremes

Figure 24 displays (a) the number of EN onsets (NENO), (b) the number of EN months (NENM), (c) the number of LN onsets (NLNO), and (d) the number of LN months (NLNM) per decade (i.e., 1870–1879, 1880–1889, etc.) based on D(m2). For EN events, there has always been at least one EN onset occurring per decade, with two EN onsets per decade occurring about half of the time. The most number of EN onsets per decade has been four during the decades of 1900–1909, 1960–1969, 1990–1999, and 2000–2009. For LN events, there has always been at least one LN onset occurring per decade, which also is the most frequently observed rate, having occurred about half of the time. Decades of three or more LN onsets per decade include 1870–1879, 1900–1909, 1970–1979, and 1980–1989. During the last decade, only one LN event had an onset, the LN event of August 2007 (10-month duration).

For EN events, the NENM has been strikingly upwards since the decade of 1920–1929, as evinced by the inferred regression line. Presuming the validity of the inferred regression, extrapolation to the present decade (2010–2019), one projects NENM to be equal to about  $37 \pm 3$  months (using the midpoint of the decade, 2014.5 in the regression), which suggests that one should expect about 3–4 EN onsets during the present decade. Based on the 2×2 contingency table, while there appears to be a loose association between NENM and decadal time, the probability of obtaining the observed distribution, or one more suggestive of independence, is  $P = 14.3\%$ , indicating that the overall behavior possibly could be due to chance. The two largest NENM (41 months) occurred during the decades of 1900–1909 and 1990–1999.

For LN events, a strikingly downward progression is inferred for NLNM between the decades of 1870–1879 and 1940–1949. Since the decade of 1940–1949, however, NLNM has shown no distinctive pattern, sometimes being above and sometimes being below the median (22.5 months). The highest NLNM values occurred in the decades of 1870–1879 (48 months), 1950–1959 (46 months), and 1970–1979 (44 months). For the past decade (2000–2009), there were only 10 LN months, as previously noted (the August 2007 LN event).

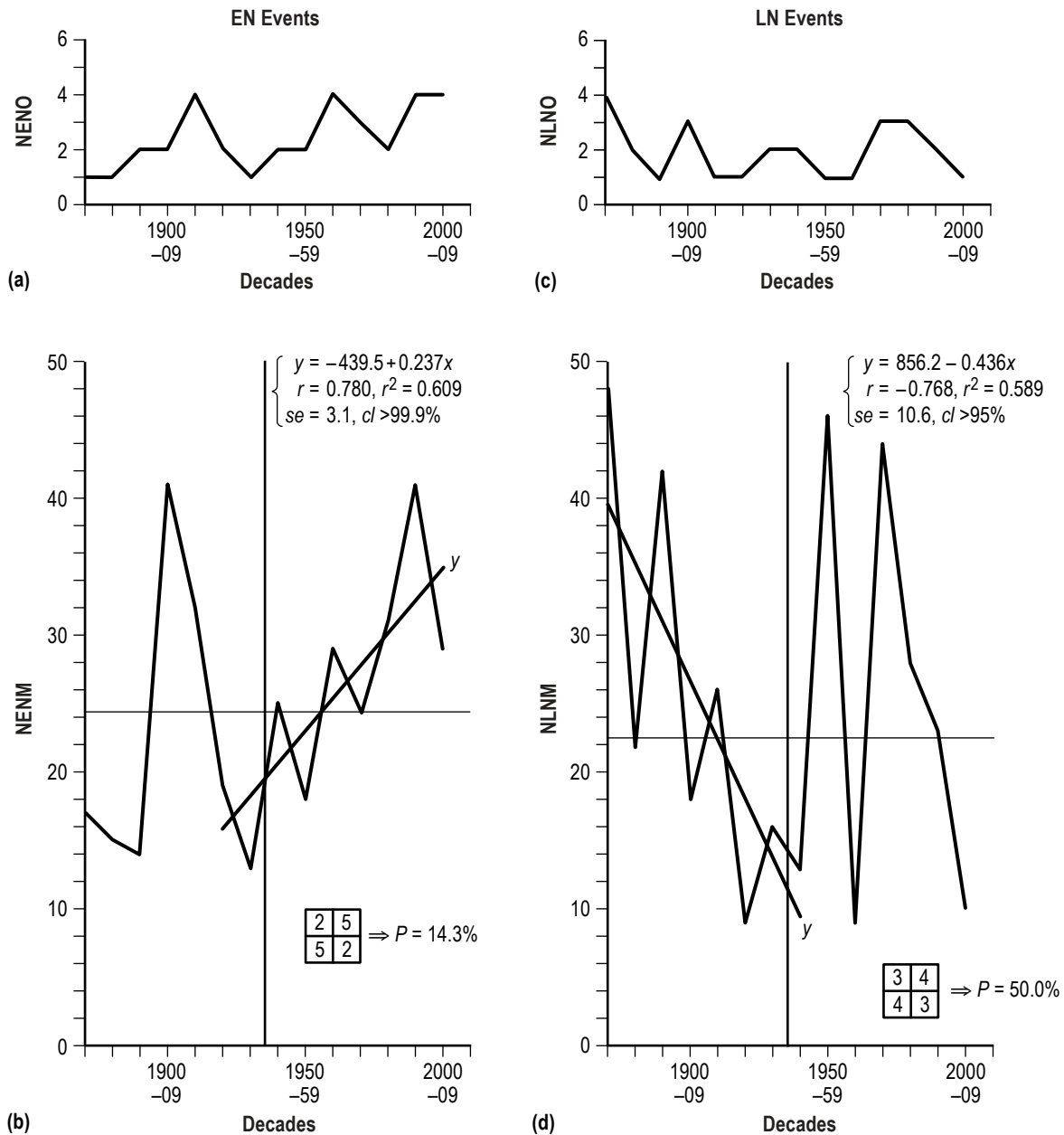


Figure 24. Decadal variation of (a) NENO, (b) NENM, (c) NLNO, and (d) NLNM based on D(m2). The 2009 EN event observed in ONI has been included with the 2000–2009 decade, even though HadSST values have not yet been published.

### 3. SUMMARY

This study has examined the HadSST dataset for the Niño 3.4 region for the interval 1871–present,<sup>26,27</sup> investigating the onsets, strengths, and durations of EN and LN events. Also, comparison was made against both SOI values for the same time interval and the ONI-determined listing of ENSO extremes since 1950 to see what differences might possibly exist, if any, especially with regard to the identification of the occurrence, strength, and duration of ENSO extremes. Additionally, the duration-maximum anomaly excursion temperature association for ENSO extremes and the RP-duration association, previously found for EN events using ONI, were investigated to determine if they also might exist using the HadSST dataset, and the decadal aspects of the ENSO extremes were examined, anticipating what possibly might lie ahead for the current decade (2010–2019). Finally, table 7 is included in the Appendix, providing the monthly values of HadSST, 2-mma values of HadSST, 12-mma values of HadSST, the monthly differences between HadSST and the monthly adjusted average for 1871–2008 ( $D(m)$ ), 2-mma values of  $D(m)$  ( $D(m2)$ ), ONI, SOI, SOI(2), and comments. The comments column notes the occurrences of ENSO extremes based on  $D(m2)$ , giving their start, peak, and end dates, as well as the strength of the individual peaks within each ENSO extreme event. For 1950–present, the occurrences of ENSO extremes are also shown based on ONI, marking their occurrences of start, peak, and end dates for comparison with  $D(m2)$ . The monthly adjusted averages of HadSST appear at the bottom of table 7.

This investigation has shown that the annual mean HadSST temperature for the Niño 3.4 region has averaged 26.95 °C between January 1871 and April 2009, with annual means varying nonrandomly, indicating the presence of a strong decadal signal imbedded within the dataset. Additionally, inferred was a possible rise over time of the annual mean SST temperature, but one of only marginal statistical importance (which disappears if one ignores the earliest portion of the data, prior to about 1895). Similar features are apparent in the annual highs, lows, and differences (i.e., high minus low values). Twelve-month moving averages of the nonseasonally adjusted monthly means of HadSST reveal strong episodic behavior, consisting of long intervals of warmer and cooler SST relative to the long-term mean. These episodes suggest the occurrences of long-term anomalous warming and cooling events. Instead, on the basis of 2-mma values of the seasonally adjusted monthly means of HadSST ( $D(m2)$ ), one determines the occurrences of short-term episodes of warming and cooling, which are identified as EN and LN events, respectively (intervals of time when the anomalous monthly temperatures exceed specific thresholds continuously for a length of time longer than a specific minimum length).

For the interval February 1871–March 2009, the HadSST dataset is found to contain some 60 ENSO extreme events, consisting of 33 EN and 27 LN events. The duration of an ENSO extreme event is found to be associated with the strength of the event such that stronger events (those having larger anomalous temperature excursions) tend to persist longer than weaker events.

A comparison of D(m2) against SOI(2) and ONI during the ONI base period (1971–2000) reveals strong statistical correlation between D(m2) and both SOI(2) and, especially, ONI. The inferred correlation between D(m2) and SOI(2) has  $r = -0.84$ , meaning that the two descriptors of ENSO extreme events behave oppositely, warmer anomalous temperatures being associated with negative anomalous pressure differences, and cooler anomalous temperatures being associated with positive anomalous pressure differences. The inferred correlation between D(m2) and ONI is even stronger, having  $r = 0.99$ .

Comparison of the identification of EN and LN events using both the D(m2)- and ONI-determined listings for the interval 1950–2008 reveals subtle differences. For example, the very strong June 1973 LN (duration 13 months) and strong April 1975 LN (duration 12 months) events are identified as one long continuous strong LN event (with multiple peaks) in the ONI listing instead of two separate events. Other differences include the inclusion of a weak LN event of 5-months duration and a moderate EN event of 5-months duration in the D(m2) listing but neither appearing in the ONI listing of events, and the inclusion of a weak LN event of 5-months duration in the ONI listing but not appearing in the D(m2) listing of events. For the interval 1950–2008, ONI-determined extremes tend to be slightly longer in duration (about 1 month) than measured using D(m2).

For both D(m2)- and ONI-determined extremes, strong associations are inferred to exist between the duration of the events and their maximum anomalous excursion temperatures. Hence, based on D(m2), when max D(m2) was  $1.38\text{ }^{\circ}\text{C}$  or warmer, the duration of the EN event was 10 months or longer (10–19 months, true for 17 of 17 EN events), and, when max D(m2) was  $-1.22\text{ }^{\circ}\text{C}$  or cooler, the duration of the LN event was 9 months or longer (9–31 months, true for 12 of 12 LN events). Similar results are found for ENSO extreme events based on ONI.

For both D(m2)- and ONI-determined ENSO extremes, a very strong association is inferred to exist between the occurrence of the next EN event and the duration of the last known EN event. For the interval 1950–2009, ONI-determined EN events tend to recur within 36 months when the duration of the last known EN event is less than 9 months, true for 6 of 8 EN events, while when the duration of the last known EN event is 10 months or longer, the recurrence rate tends to be 36 months or longer, true for 8 of 9 EN events. For the interval 1871–2008, D(m2)-determined EN events tend to recur within 37 months when the duration of the last known EN event is 10 months or less, true for 13 of 16 EN events, while when the duration of the last known EN event is 11 months or longer, the recurrence rate tends to be 41 months or longer, true for 13 of 16 EN events. Because the S 2009 EN event (recorded in the ONI-listing but not yet appearing in the HadSST dataset) has already persisted for 8 months (thru January 2010) and S EN events tend to persist 11–19 months (based on ONI, the shortest D(m2)-determined S EN persisted only 9 months, with 12 of 13 S EN events persisting 11–17 months), one should not expect another EN event to recur until June 2012 or later. (No such preferential association is found for LN events, either in the D(m2)- or ONI-determined listings.)

Finally, this study has shown that, since about the decade 1920–1929 the NENM have increased over time (in a saw-tooth pattern). Extrapolating the fit to the present decade (2010–2019), presuming the pattern to continue, one expects  $\text{NENM} = 37 \pm 3$  months, probably  $\geq 37$  months (from the inferred saw-tooth pattern). This seems to indicate that one should expect about 3–4 EN events

during the present decade. For NLNM, the indication is that it decreased over time between the decades 1870–1879 and 1940–1949, but no preferential rise has since been seen. Instead, after two large increases during the decades 1950–1959 and 1970–1979, NLNM has steadily declined again from 44 months in the decade 1970–1979 to only 10 months in the last decade (2000–2009). It is unclear what the present decade will experience with regards to LN events. The median value for NLNM is 22.5 months per decade.

In conclusion, the D(m2) index, based on seasonally adjusted monthly HadSST values, can be used to describe ENSO conditions and identify ENSO extreme events. This study also confirms the existence of preferential behavior between the recurrence rate of EN events and the duration of the last known EN event, as well as, between the duration of an ENSO extreme event (both EN and LN events) and its maximum anomalous excursion temperature.

## APPENDIX

Table 7 is included to provide monthly values of HadSST, 2-mma values of HadSST, 12-mma values of HadSST, the monthly differences between HadSST and the monthly adjusted average for 1871–2008 ( $D(m)$ ), 2-mma values of  $D(m)$  ( $D(m2)$ ), ONI, SOI, SOI(2), and comments. The comments column notes the occurrences of ENSO extremes based on  $D(m2)$ , giving their start, peak, and end dates, as well as, the strength of the individual peaks. For 1950–present, the occurrences of ENSO extremes are also shown for ONI, marking the occurrences of the start, peak, and end dates, for comparison with  $D(m2)$ . The monthly-adjusted averages of HadSST appear at the bottom of table 7.

Table 7. SST monthly values of the Niño 3.4 region in degrees Celsius based on HadSST time series, ONI and SOI values, and the occurrences of EN (warm) and LN (cold) events from 1871 to the present.

Year	Mon	HadSST	2-mma	12-mma	D(m)	D(m <sup>2</sup> )	ONI	SOI*	SOI(2)	Comments**
1871	01	26.33	–	–	–0.21	–	–	–11.3	–9.2	
	02	26.18	26.38	–	–0.54	–0.40	–	–1.3	–8.5	
	03	26.83	26.78	–	–0.30	–0.38	–	–20.0	–11.5	
	04	27.27	27.13	–	–0.37	–0.39	–	–4.6	–8.5	
	05	27.16	27.19	–	–0.53	–0.46	–	–4.7	–2.9	
	06	27.16	27.03	–	–0.40	–0.45	–	2.4	0.8	
	07	26.62	26.74	26.59	–0.45	–0.38	–	3.1	3.1	
	08	26.54	26.55	26.57	–0.22	–0.25	–	3.8	4.1	
	09	26.51	26.49	26.57	–0.11	–0.17	–	5.8	3.5	
	10	26.40	26.42	26.55	–0.23	–0.19	–	–1.4	0.7	
	11	26.35	26.28	26.55	–0.18	–0.28	–	–0.2	2.0	
	12	26.01	26.06	26.55	–0.53	–0.48	–	9.7	11.5	
1872	01	25.86	25.97	26.56	–0.68	–0.62	–	26.9	18.7	
	02	26.14	26.23	26.55	–0.58	–0.55	–	11.2	16.6	
	03	26.76	26.67	26.50	–0.37	–0.49	–	16.9	9.9	
	04	27.00	27.00	26.44	–0.64	–0.52	–	–5.4	4.9	
	05	27.25	27.17	26.39	–0.44	–0.48	–	13.5	11.5	
	06	27.16	27.12	26.36	–0.40	–0.35	–	24.5	21.4	
	07	26.91	26.75	26.35	–0.16	–0.37	–	23.0	20.1	
	08	26.02	26.17	26.33	–0.74	–0.63	–	9.9	18.6	LN start
	09	25.73	25.82	26.28	–0.89	–0.84	–	31.4	22.7	LN
	10	25.79	25.79	26.25	–0.84	–0.81	–	19.0	25.1	LN
	11	25.86	25.81	26.26	–0.67	–0.75	–	30.9	27.2	LN
	12	25.71	25.77	26.26	–0.83	–0.77	–	28.0	27.9	LN
1873	01	25.79	25.76	26.25	–0.75	–0.83	–	24.7	22.2	LN
	02	25.75	25.81	26.26	–0.97	–0.97	–	11.2	15.9	LN peak (W)
	03	25.95	26.19	26.31	–1.18	–0.97	–	16.3	16.7	LN
	04	27.10	26.87	26.34	–0.54	–0.66	–	22.9	18.5	LN end
	05	27.33	27.24	26.35	–0.36	–0.40	–	11.9	4.0	
	06	27.21	27.10	26.36	–0.35	–0.37	–	–30.9	–15.3	
	07	26.65	26.75	26.36	–0.42	–0.37	–	–11.4	–14.9	
	08	26.48	26.51	26.35	–0.28	–0.30	–	–5.9	–11.1	
	09	26.41	26.32	26.35	–0.21	–0.34	–	–21.3	–16.6	
	10	25.96	26.05	26.33	–0.67	–0.55	–	–17.8	–15.1	LN start
	11	25.88	25.90	26.31	–0.65	–0.66	–	–3.6	–2.9	LN
	12	25.89	25.83	26.28	–0.65	–0.71	–	13.3	8.0	LN
1874	01	25.64	25.72	26.25	–0.90	–0.87	–	9.0	7.1	LN
	02	25.70	25.72	26.21	–1.02	–1.06	–	–2.8	–0.5	LN
	03	25.85	26.06	26.15	–1.28	–1.10	–	–5.2	–0.9	LN peak 1 (M)
	04	26.83	26.63	26.09	–0.81	–0.90	–	9.8	6.8	LN
	05	27.00	26.95	26.05	–0.69	–0.70	–	12.9	4.1	LN
	06	26.96	26.79	26.01	–0.60	–0.69	–	–19.2	–6.7	LN
	07	26.22	26.31	26.00	–0.85	–0.81	–	–1.4	–3.6	LN
	08	25.82	25.87	26.04	–0.94	–0.93	–	7.5	8.5	LN
	09	25.62	25.64	26.10	–1.00	–1.02	–	20.3	17.5	LN
	10	25.49	25.48	26.14	–1.14	–1.12	–	21.9	17.4	LN
	11	25.33	25.40	26.13	–1.20	–1.16	–	5.3	11.3	LN peak 2 (M)
	12	25.45	25.53	26.12	–1.09	–1.01	–	12.8	9.4	LN



Table 7. SST monthly values of the Niño 3.4 region in degrees Celsius based on HadSST time series, ONI and SOI values, and the occurrences of EN (warm) and LN (cold) events from 1871 to the present (Continued).

Year	Mon	HadSST	2-mma	12-mma	D(m)	D(m <sup>2</sup> )	ONI	SOI*	SOI(2)	Comments**
1875	01	25.87	25.90	26.13	-0.67	-0.69	-	6.5	6.2	LN end
	02	26.39	26.33	26.14	-0.33	-0.45	-	-1.1	-1.4	
	03	26.66	26.65	26.16	-0.47	-0.50	-	-10.0	-1.8	LN start
	04	26.90	26.81	26.19	-0.74	-0.72	-	14.0	6.4	LN
	05	26.77	26.84	26.23	-0.92	-0.81	-	7.5	13.7	LN peak 1 (W)
	06	26.92	26.75	26.28	-0.64	-0.73	-	25.7	13.5	LN
	07	26.37	26.43	26.28	-0.70	-0.69	-	-4.9	3.5	LN
	08	26.06	26.08	26.24	-0.70	-0.72	-	-2.1	-0.2	LN
	09	25.84	25.91	26.18	-0.78	-0.75	-	8.3	6.0	LN peak 2 (W)
	10	25.90	25.91	26.15	-0.73	-0.69	-	9.3	2.9	LN
	11	26.01	25.94	26.13	-0.52	-0.62	-	-15.4	-6.7	LN
	12	25.83	25.83	26.15	-0.71	-0.71	-	-5.4	-3.7	LN
1876	01	25.63	25.66	26.18	-0.91	-0.92	-	11.3	7.1	LN
	02	25.56	25.72	26.23	-1.16	-1.06	-	11.0	8.4	LN peak 3 (M)
	03	26.13	26.10	26.30	-1.00	-1.05	-	0.2	5.2	LN
	04	26.59	26.52	26.37	-1.05	-1.00	-	9.4	6.5	LN
	05	26.78	26.85	26.45	-0.91	-0.80	-	6.8	10.1	LN end
	06	27.25	27.04	26.52	-0.31	-0.43	-	17.2	8.9	
	07	26.88	26.93	26.61	-0.19	-0.19	-	-5.6	4.6	
	08	26.71	26.76	26.74	-0.05	-0.05	-	12.3	7.4	
	09	26.73	26.76	26.88	0.11	0.10	-	10.5	6.3	
	10	26.85	26.81	27.01	0.22	0.21	-	-8.0	-2.1	
	11	26.80	26.82	27.16	0.27	0.26	-	-2.7	-4.1	
	12	26.81	26.84	27.30	0.27	0.30	-	-3.0	-4.6	
1877	01	26.93	26.97	27.43	0.39	0.39	-	-9.7	-7.2	
	02	27.22	27.29	27.57	0.50	0.51	-	-6.5	-6.9	EN start
	03	27.78	27.76	27.72	0.65	0.61	-	-4.7	-6.4	EN
	04	28.27	28.24	27.87	0.63	0.71	-	-9.6	-5.1	EN
	05	28.62	28.55	28.03	0.93	0.90	-	3.6	-4.8	EN
	06	28.67	28.65	28.20	1.11	1.18	-	-16.8	-10.1	EN
	07	28.64	28.59	28.38	1.57	1.48	-	-10.2	-11.4	EN
	08	28.42	28.50	28.55	1.66	1.69	-	-8.2	-11.0	EN
	09	28.50	28.53	28.66	1.88	1.87	-	-17.2	-14.7	EN
	10	28.68	28.65	28.71	2.05	2.05	-	-16.0	-15.5	EN
	11	28.74	28.81	28.73	2.21	2.25	-	-12.6	-13.5	EN
	12	29.07	28.97	28.74	2.53	2.43	-	-12.6	-11.6	EN
1878	01	28.99	29.06	28.68	2.45	2.48	-	-8.7	-12.8	EN peak (VS)
	02	29.19	28.99	28.57	2.47	2.21	-	-21.1	-16.6	EN
	03	28.57	28.76	28.41	1.44	1.60	-	-15.5	-15.2	EN
	04	28.69	28.66	28.22	1.05	1.14	-	-8.8	-7.8	EN
	05	28.69	28.67	28.00	1.00	1.03	-	2.1	-1.9	EN
	06	28.61	28.35	27.75	1.05	0.88	-	-3.1	3.0	EN end
	07	27.48	27.58	27.49	0.41	0.47	-	15.9	10.4	
	08	26.76	26.86	27.26	0.00	0.06	-	13.0	14.9	
	09	26.43	26.46	27.09	-0.19	-0.20	-	17.7	14.8	
	10	26.20	26.20	26.97	-0.43	-0.41	-	10.9	13.7	
	11	25.95	25.98	26.85	-0.58	-0.55	-	15.1	14.8	
	12	25.83	25.91	26.71	-0.71	-0.63	-	17.9	15.9	

Table 7. SST monthly values of the Niño 3.4 region in degrees Celsius based on HadSST time series, ONI and SOI values, and the occurrences of EN (warm) and LN (cold) events from 1871 to the present (Continued).

Year	Mon	HadSST	2-mma	12-mma	D(m)	D(m <sup>2</sup> )	ONI	SOI*	SOI(2)	Comments**
1879	01	26.03	26.12	26.60	-0.51	-0.47	-	12.7	14.4	
	02	26.58	26.55	26.54	-0.14	-0.23	-	14.3	13.6	
	03	27.02	27.01	26.49	-0.11	-0.15	-	13.2	13.4	
	04	27.40	27.21	26.45	-0.24	-0.31	-	12.7	10.2	
	05	27.03	27.12	26.42	-0.66	-0.53	-	2.1	8.3	LN start
	06	27.02	26.88	26.39	-0.54	-0.59	-	16.4	14.2	LN
	07	26.46	26.53	26.36	-0.61	-0.59	-	21.8	20.7	LN
	08	26.18	26.19	26.32	-0.58	-0.62	-	22.6	21.5	LN
	09	25.93	25.96	26.28	-0.69	-0.70	-	18.9	18.9	LN
	10	25.80	25.76	26.25	-0.83	-0.84	-	15.2	14.8	LN
	11	25.52	25.60	26.25	-1.01	-0.96	-	9.8	7.3	LN
	12	25.56	25.56	26.26	-0.98	-0.98	-	-5.5	2.4	LN peak (W)
1880	01	25.58	25.69	26.27	-0.96	-0.90	-	10.8	6.0	LN
	02	26.03	26.07	26.30	-0.69	-0.71	-	7.7	10.1	LN
	03	26.63	26.62	26.35	-0.50	-0.53	-	14.3	10.4	LN end
	04	27.20	27.05	26.43	-0.44	-0.48	-	5.3	9.3	
	05	27.15	27.17	26.53	-0.54	-0.50	-	12.3	9.8	
	06	27.08	27.00	26.64	-0.48	-0.47	-	9.1	8.0	
	07	26.70	26.78	26.74	-0.37	-0.34	-	1.6	6.7	
	08	26.63	26.67	26.84	-0.13	-0.13	-	14.3	9.6	
	09	26.72	26.74	26.92	0.10	0.09	-	8.1	8.8	
	10	26.90	26.86	27.00	0.27	0.25	-	4.8	6.2	
	11	26.90	26.87	27.08	0.37	0.31	-	7.2	4.3	
	12	26.77	26.83	27.15	0.23	0.29	-	-1.9	-1.0	
1881	01	26.87	26.88	27.19	0.33	0.29	-	-7.3	-5.5	
	02	26.99	27.11	27.21	0.27	0.33	-	-5.5	-4.1	
	03	27.58	27.58	27.20	0.45	0.43	-	1.8	-0.4	
	04	28.18	27.99	27.16	0.54	0.47	-	0.3	-0.5	
	05	28.03	28.04	27.10	0.34	0.40	-	-4.3	-3.3	
	06	27.92	27.71	27.04	0.36	0.24	-	-4.7	-4.8	
	07	26.96	27.14	26.99	-0.11	0.02	-	-5.6	-6.8	
	08	26.71	26.70	26.93	-0.05	-0.10	-	-11.4	-10.5	
	09	26.42	26.47	26.86	-0.20	-0.19	-	-13.6	-15.6	
	10	26.31	26.28	26.81	-0.32	-0.33	-	-23.9	-13.6	
	11	26.06	26.16	26.79	-0.47	-0.40	-	7.2	0.1	
	12	26.22	26.16	26.76	-0.32	-0.38	-	9.8	5.0	
1882	01	26.13	26.17	26.72	-0.41	-0.41	-	-6.8	-1.3	
	02	26.21	26.32	26.70	-0.51	-0.46	-	-1.3	-1.1	
	03	26.73	26.89	26.69	-0.40	-0.27	-	5.1	2.5	
	04	27.87	27.59	26.67	0.23	0.06	-	1.2	3.6	
	05	27.88	27.73	26.65	0.19	0.09	-	6.8	0.7	
	06	27.29	27.28	26.62	-0.27	-0.19	-	-12.0	-9.6	
	07	26.65	26.79	26.60	-0.42	-0.33	-	-21.3	-20.1	
	08	26.55	26.50	26.60	-0.21	-0.31	-	-25.6	-21.8	
	09	26.24	26.28	26.61	-0.38	-0.38	-	-14.8	-14.4	
	10	26.08	26.04	26.60	-0.55	-0.57	-	-2.5	-4.3	
	11	25.74	25.85	26.57	-0.79	-0.71	-	2.6	3.3	
	12	25.83	25.88	26.56	-0.71	-0.66	-	10.3	7.3	

Table 7. SST monthly values of the Niño 3.4 region in degrees Celsius based on HadSST time series, ONI and SOI values, and the occurrences of EN (warm) and LN (cold) events from 1871 to the present (Continued).

Year	Mon	HadSST	2-mma	12-mma	D(m)	D(m <sup>2</sup> )	ONI	SOI*	SOI(2)	Comments**
1883	01	26.12	26.09	26.59	-0.42	-0.50	-	6.0	7.9	
	02	26.27	26.38	26.63	-0.45	-0.40	-	9.1	-0.3	
	03	26.86	26.88	26.66	-0.27	-0.27	-	-25.3	-6.8	
	04	27.54	27.36	26.68	-0.10	-0.17	-	14.4	4.4	
	05	27.49	27.50	26.72	-0.20	-0.15	-	13.9	11.4	
	06	27.48	27.42	26.77	-0.08	-0.06	-	3.4	2.6	
	07	27.21	27.19	26.81	0.14	0.07	-	-10.2	-3.9	
	08	26.85	26.87	26.85	0.09	0.07	-	1.4	-3.9	
	09	26.58	26.58	26.89	-0.04	-0.08	-	-8.2	-2.6	
	10	26.32	26.41	26.92	-0.31	-0.19	-	4.8	1.7	
	11	26.43	26.41	26.97	-0.10	-0.15	-	5.2	0.0	
	12	26.44	26.45	27.01	-0.10	-0.09	-	-15.2	-9.4	
1884	01	26.47	26.53	27.03	-0.07	-0.05	-	-12.5	-11.3	
	02	26.75	26.81	27.05	0.03	0.03	-	-5.0	-3.3	
	03	27.26	27.33	27.07	0.13	0.17	-	9.4	-0.4	
	04	28.03	27.90	27.12	0.39	0.37	-	-15.4	-5.0	
	05	28.26	28.03	27.17	0.57	0.38	-	1.3	-0.9	
	06	27.55	27.72	27.21	-0.01	0.25	-	9.1	4.1	
	07	27.51	27.41	27.24	0.44	0.30	-	-3.0	-0.5	
	08	27.08	27.15	27.26	0.32	0.35	-	-5.0	-5.0	
	09	26.94	27.00	27.28	0.32	0.34	-	-7.0	-3.7	
	10	27.02	26.98	27.27	0.39	0.38	-	4.2	0.0	
	11	26.95	26.96	27.26	0.42	0.41	-	-1.4	-2.8	
	12	26.93	26.88	27.27	0.39	0.34	-	-12.6	-10.7	
1885	01	26.70	26.84	27.28	0.16	0.26	-	-16.3	-10.9	
	02	27.03	27.04	27.27	0.31	0.26	-	1.6	-2.0	
	03	27.38	27.39	27.29	0.25	0.23	-	5.1	2.8	
	04	27.75	27.80	27.33	0.11	0.27	-	-0.5	-0.1	
	05	28.30	28.05	27.36	0.61	0.41	-	-4.3	-5.9	
	06	27.85	27.83	27.41	0.29	0.36	-	-14.4	-9.5	
	07	27.30	27.42	27.44	0.23	0.30	-	-5.0	-8.5	
	08	27.21	27.25	27.43	0.45	0.45	-	-9.5	-7.0	
	09	27.27	27.30	27.41	0.65	0.64	-	-4.0	-8.8	
	10	27.45	27.41	27.38	0.82	0.81	-	-17.8	-13.9	
	11	27.46	27.50	27.32	0.93	0.94	-	-15.9	-11.1	
	12	27.61	27.36	27.22	1.07	0.82	-	5.2	-1.5	
1886	01	26.75	26.95	27.13	0.21	0.36	-	-0.6	1.4	
	02	26.67	26.81	27.03	-0.05	0.03	-	1.6	1.4	
	03	27.15	27.09	26.90	0.02	-0.06	-	2.9	3.0	
	04	27.40	27.24	26.75	-0.24	-0.28	-	4.5	4.5	
	05	27.02	27.06	26.58	-0.67	-0.59	-	6.0	5.4	LN start
	06	26.79	26.71	26.39	-0.77	-0.76	-	5.0	5.9	LN
	07	26.25	26.29	26.25	-0.82	-0.83	-	7.4	8.4	LN
	08	25.85	25.87	26.18	-0.91	-0.93	-	13.6	12.0	LN
	09	25.54	25.63	26.10	-1.08	-1.03	-	13.5	13.5	LN
	10	25.59	25.51	26.02	-1.04	-1.10	-	13.4	12.7	LN
	11	25.31	25.34	25.97	-1.22	-1.22	-	10.5	12.2	LN peak 1 (M)
	12	25.15	25.38	25.97	-1.39	-1.16	-	14.4	12.9	LN

Table 7. SST monthly values of the Niño 3.4 region in degrees Celsius based on HadSST time series, ONI and SOI values, and the occurrences of EN (warm) and LN (cold) events from 1871 to the present (Continued).

Year	Mon	HadSST	2-mma	12-mma	D(m)	D(m <sup>2</sup> )	ONI	SOI*	SOI(2)	Comments**
1887	01	25.90	25.67	26.00	-0.64	-0.91	-	12.2	12.5	LN
	02	25.74	25.87	26.04	-0.98	-0.91	-	11.0	11.1	LN
	03	26.08	26.12	26.09	-1.05	-1.03	-	10.0	10.1	LN peak 2 (M)
	04	26.59	26.50	26.17	-1.05	-1.03	-	9.4	6.1	LN peak 2 (M)
	05	26.72	26.79	26.27	-0.97	-0.86	-	-4.3	1.5	LN
	06	27.12	26.91	26.39	-0.44	-0.56	-	5.0	2.6	LN end
	07	26.68	26.68	26.54	-0.39	-0.43	-	4.8	4.8	
	08	26.25	26.40	26.60	-0.51	-0.41	-	4.6	4.8	
	09	26.41	26.42	26.74	-0.21	-0.24	-	5.1	4.9	
	10	26.61	26.58	26.86	-0.02	-0.02	-	4.8	2.4	
	11	26.69	26.68	26.99	0.16	0.13	-	-5.3	-0.2	
	12	26.74	26.73	27.10	0.20	0.19	-	5.2	0.5	
1888	01	26.73	26.91	27.19	0.19	0.32	-	-3.0	-0.8	
	02	27.42	27.31	27.30	0.70	0.53	-	-2.2	-4.8	EN start
	03	27.66	27.70	27.40	0.53	0.55	-	-11.7	-12.3	EN peak 1 (W)
	04	28.07	28.04	27.50	0.43	0.51	-	-23.6	-17.2	EN
	05	28.34	28.21	27.66	0.65	0.57	-	-9.8	-14.8	EN
	06	28.09	28.08	27.81	0.53	0.61	-	-16.0	-14.6	EN
	07	27.78	27.86	27.95	0.71	0.75	-	-16.7	-14.6	EN
	08	27.80	27.68	28.06	1.04	0.88	-	-8.9	-11.0	EN
	09	27.33	27.66	28.11	0.71	1.00	-	-9.4	-10.6	EN
	10	28.16	28.13	28.14	1.53	1.53	-	-14.7	-12.9	EN
	11	28.86	28.54	28.14	2.33	1.98	-	-12.6	-10.6	EN peak 2 (S)
	12	28.26	28.49	28.12	1.72	1.95	-	-2.4	-10.8	EN
1889	01	28.56	28.41	28.05	2.02	1.82	-	-25.9	-14.0	EN
	02	28.24	28.28	27.92	1.52	1.51	-	-1.7	-14.2	EN
	03	28.09	28.16	27.78	0.96	1.01	-	-27.5	-14.3	EN
	04	28.23	28.19	27.60	0.59	0.66	-	-0.5	-7.6	EN end
	05	28.19	28.10	27.35	0.50	0.45	-	-1.9	4.4	
	06	27.78	27.56	27.09	0.22	0.09	-	22.0	10.9	
	07	26.47	26.65	26.78	-0.60	-0.47	-	1.6	6.8	
	08	25.88	26.02	26.44	-0.88	-0.79	-	2.1	4.2	LN start
	09	25.83	25.74	26.21	-0.79	-0.92	-	11.1	7.1	LN
	10	25.42	25.56	26.06	-1.21	-1.04	-	4.2	10.6	LN
	11	25.57	25.48	25.94	-0.96	-1.08	-	23.0	18.1	LN
	12	25.34	25.09	25.85	-1.20	-1.45	-	22.0	22.0	LN
1890	01	24.09	24.54	25.80	-2.45	-2.04	-	20.8	18.7	LN peak 1 (VS)
	02	24.65	24.88	25.78	-2.07	-1.90	-	11.0	14.3	LN
	03	26.11	25.88	25.75	-1.02	-1.28	-	14.3	11.6	LN
	04	26.63	26.56	25.73	-1.01	-0.97	-	6.9	7.9	LN
	05	26.87	26.80	25.73	-0.82	-0.85	-	3.6	5.0	LN
	06	26.82	26.70	25.76	-0.74	-0.77	-	5.8	3.2	LN
	07	26.30	26.23	25.87	-0.77	-0.89	-	-2.3	-0.5	LN
	08	25.50	25.69	26.03	-1.26	-1.11	-	-3.1	0.2	LN
	09	25.46	25.47	26.15	-1.16	-1.19	-	9.3	4.8	LN peak 2 (M)
	10	25.47	25.50	26.25	-1.16	-1.11	-	3.6	4.8	LN
	11	25.58	25.63	26.35	-0.95	-0.93	-	2.6	2.4	LN
	12	25.90	25.88	26.45	-0.64	-0.66	-	0.6	4.9	LN end

Table 7. SST monthly values of the Niño 3.4 region in degrees Celsius based on HadSST time series, ONI and SOI values, and the occurrences of EN (warm) and LN (cold) events from 1871 to the present (Continued).

Year	Mon	HadSST	2-mma	12-mma	D(m)	D(m <sup>2</sup> )	ONI	SOI*	SOI(2)	Comments**
1891	01	26.13	26.17	26.54	-0.41	-0.42	-	15.6	7.1	
	02	26.51	26.59	26.64	-0.21	-0.19	-	-3.6	-0.3	
	03	27.19	27.20	26.75	0.06	0.05	-	-9.5	-4.5	
	04	27.92	27.76	26.85	0.28	0.23	-	4.5	-0.2	
	05	27.99	27.97	26.95	0.30	0.32	-	-0.3	0.6	
	06	27.97	27.82	27.03	0.41	0.35	-	-1.5	-2.4	
	07	27.34	27.40	27.05	0.27	0.28	-	-6.3	-5.8	
	08	26.93	26.97	27.05	0.17	0.17	-	-8.9	-8.7	
	09	26.67	26.74	27.02	0.05	0.09	-	-10.6	-7.4	
	10	26.70	26.70	26.97	0.07	0.09	-	0.6	-3.5	
	11	26.71	26.68	26.90	0.18	0.12	-	-4.7	-3.3	
	12	26.60	26.50	26.83	0.06	-0.04	-	-4.5	-2.8	
1892	01	26.08	26.30	26.76	-0.46	-0.29	-	2.7	-2.3	
	02	26.42	26.40	26.70	-0.30	-0.38	-	-10.2	-1.7	
	03	26.68	26.73	26.63	-0.45	-0.43	-	11.1	4.7	
	04	27.12	27.02	26.53	-0.52	-0.51	-	6.9	8.7	
	05	27.14	27.13	26.40	-0.55	-0.52	-	10.0	11.6	
	06	27.12	27.00	26.28	-0.44	-0.48	-	19.6	14.2	
	07	26.60	26.64	26.20	-0.47	-0.47	-	7.4	10.1	
	08	26.25	26.20	26.13	-0.51	-0.61	-	5.9	6.4	LN start
	09	25.68	25.70	26.07	-0.94	-0.96	-	6.3	6.8	LN
	10	25.19	25.27	26.02	-1.44	-1.33	-	8.5	5.7	LN
	11	25.03	25.17	25.96	-1.50	-1.39	-	-0.7	2.7	LN peak 1 (M)
	12	25.41	25.30	25.91	-1.13	-1.24	-	3.7	4.5	LN
1893	01	25.35	25.43	25.86	-1.19	-1.16	-	11.3	8.5	LN
	02	25.60	25.64	25.80	-1.12	-1.14	-	7.7	6.3	LN
	03	26.02	26.03	25.77	-1.11	-1.13	-	-1.4	1.5	LN
	04	26.47	26.38	25.77	-1.17	-1.15	-	1.2	-0.6	LN peak 2 (M)
	05	26.55	26.52	25.79	-1.14	-1.13	-	-3.5	1.2	LN
	06	26.50	26.37	25.81	-1.06	-1.11	-	10.7	8.0	LN
	07	25.91	25.98	25.82	-1.16	-1.14	-	14.0	11.6	LN
	08	25.58	25.64	25.83	-1.18	-1.17	-	7.8	8.8	LN
	09	25.48	25.48	25.84	-1.14	-1.18	-	5.7	6.8	LN
	10	25.37	25.39	25.86	-1.26	-1.21	-	7.9	6.0	LN peak 3 (M)
	11	25.35	25.42	25.89	-1.18	-1.14	-	2.6	3.7	LN
	12	25.59	25.51	25.92	-0.95	-1.03	-	1.6	5.8	LN
1894	01	25.49	25.55	25.95	-1.05	-1.04	-	17.5	11.7	LN peak 4 (M)
	02	25.63	25.74	25.99	-1.09	-1.04	-	10.0	10.8	LN peak 4 (M)
	03	26.20	26.22	26.01	-0.93	-0.94	-	5.6	4.6	LN
	04	26.85	26.69	26.04	-0.79	-0.83	-	-3.0	-1.4	LN
	05	26.87	26.86	26.08	-0.82	-0.79	-	-5.1	-3.7	LN
	06	26.85	26.73	26.12	-0.71	-0.74	-	-1.5	-2.6	LN
	07	26.34	26.40	26.16	-0.73	-0.72	-	-2.3	-3.0	LN
	08	26.07	26.03	26.20	-0.69	-0.77	-	-5.7	-3.8	LN
	09	25.65	25.82	26.25	-0.97	-0.84	-	-1.6	-1.8	LN peak 5 (W)
	10	25.91	25.80	26.31	-0.72	-0.80	-	1.8	2.3	LN
	11	25.73	25.87	26.38	-0.80	-0.69	-	7.2	4.1	LN
	12	26.11	25.95	26.45	-0.43	-0.59	-	0.1	3.3	LN

Table 7. SST monthly values of the Niño 3.4 region in degrees Celsius based on HadSST time series, ONI and SOI values, and the occurrences of EN (warm) and LN (cold) events from 1871 to the present (Continued).

Year	Mon	HadSST	2-mma	12-mma	D(m)	D(m <sup>2</sup> )	ONI	SOI*	SOI(2)	Comments**
1895	01	25.85	26.02	26.50	-0.69	-0.56	-	5.6	3.6	LN end
	02	26.28	26.32	26.58	-0.44	-0.46	-	3.0	2.8	
	03	26.86	26.90	26.69	-0.27	-0.26	-	-0.3	-1.2	
	04	27.60	27.47	26.80	-0.04	-0.05	-	-7.1	-5.7	
	05	27.83	27.68	26.90	0.14	0.04	-	-8.2	-7.1	
	06	27.47	27.43	27.00	-0.09	-0.04	-	-4.7	-4.5	
	07	26.96	27.16	27.08	-0.11	0.04	-	-0.4	-3.0	
	08	27.23	27.15	27.14	-0.47	0.35	-	-6.3	-4.3	
	09	27.17	27.16	27.18	0.55	0.50	-	-4.0	-5.0	
	10	27.05	27.09	27.21	0.42	0.49	-	-5.6	-6.0	
	11	27.10	27.08	27.22	0.57	0.52	-	-8.6	-6.6	
	12	27.07	27.00	27.22	0.53	0.46	-	-3.5	-3.6	
1896	01	26.74	26.85	27.25	0.20	0.27	-	1.3	1.0	EN start EN EN EN EN EN peak (S)
	02	26.85	26.96	27.31	0.13	0.19	-	4.9	1.2	
	03	27.41	27.36	27.36	0.28	0.20	-	-6.3	-4.1	
	04	27.76	27.69	27.42	0.12	0.16	-	-8.8	-16.5	
	05	27.82	27.72	27.50	0.13	0.08	-	-42.2	-31.0	
	06	27.48	27.61	27.59	-0.08	0.14	-	-30.6	-31.0	
	07	27.66	27.68	27.69	0.59	0.57	-	-20.6	-23.6	
	08	27.92	27.82	27.78	1.16	1.02	-	-22.4	-21.1	
	09	27.79	27.83	27.84	1.17	1.18	-	-19.0	-19.9	
	10	27.83	27.90	27.85	1.20	1.30	-	-19.0	-17.2	
	11	28.16	28.07	27.84	1.63	1.52	-	-11.9	-14.3	
	12	28.14	28.13	27.84	1.60	1.59	-	-14.2	-13.2	
1897	01	28.07	28.05	27.83	1.53	1.46	-	-12.5	-11.7	EN EN EN end
	02	27.90	27.92	27.77	1.18	1.14	-	-7.4	-11.0	
	03	27.80	27.76	27.66	0.67	0.61	-	-16.6	-14.6	
	04	27.55	27.65	27.54	-0.09	0.12	-	-17.8	-17.3	
	05	27.69	27.65	27.38	0.00	0.00	-	-16.9	-12.9	
	06	27.66	27.58	27.21	0.10	0.11	-	0.2	-4.7	
	07	27.29	27.24	27.05	0.22	0.13	-	-2.3	-0.9	
	08	26.73	26.82	26.90	-0.03	0.01	-	0.8	-0.1	
	09	26.51	26.48	26.77	-0.11	-0.18	-	0.2	0.8	
	10	26.17	26.22	26.70	-0.46	-0.38	-	1.8	-1.1	
	11	26.04	26.11	26.66	-0.49	-0.45	-	-8.0	-1.0	
	12	26.19	26.12	26.64	-0.35	-0.42	-	10.3	4.9	
1898	01	26.07	26.13	26.60	-0.47	-0.46	-	7.0	7.7	
	02	26.19	26.23	26.54	-0.53	-0.55	-	6.3	9.7	
	03	26.47	26.57	26.52	-0.66	-0.58	-	19.2	14.0	
	04	27.16	27.02	26.53	-0.48	-0.51	-	11.1	9.9	
	05	27.28	27.28	26.54	-0.41	-0.37	-	-1.9	1.3	
	06	27.40	27.17	26.52	-0.16	-0.30	-	-2.3	-0.1	
	07	26.59	26.67	26.49	-0.48	-0.44	-	6.1	3.0	
	08	26.11	26.34	26.48	-0.65	-0.46	-	2.1	3.4	
	09	26.56	26.41	26.48	-0.06	-0.25	-	3.2	2.0	
	10	26.40	26.34	26.50	-0.23	-0.26	-	-0.7	-0.2	
	11	26.00	26.05	26.54	-0.53	-0.51	-	-2.7	-1.6	
	12	25.80	25.86	26.58	-0.74	-0.68	-	-0.4	2.4	

Table 7. SST monthly values of the Niño 3.4 region in degrees Celsius based on HadSST time series, ONI and SOI values, and the occurrences of EN (warm) and LN (cold) events from 1871 to the present (Continued).

Year	Mon	HadSST	2-mma	12-mma	D(m)	D(m <sup>2</sup> )	ONI	SOI*	SOI(2)	Comments**
1899	01	25.83	25.88	26.62	-0.71	-0.71	-	13.2	8.8	
	02	26.05	26.16	26.70	-0.67	-0.62	-	9.1	11.3	
	03	26.69	26.72	26.79	-0.44	-0.44	-	13.8	10.3	
	04	27.43	27.25	26.87	-0.21	-0.16	-	4.5	3.9	
	05	27.90	27.75	27.00	0.21	0.11	-	-7.4	-5.2	
	06	27.78	27.67	27.18	0.22	0.20	-	-10.4	-8.5	
	07	27.20	27.42	27.36	0.13	0.31	-	-5.6	-7.9	
	08	27.51	27.35	27.54	0.75	0.55	-	-10.1	-6.9	EN start
	09	27.18	27.38	27.68	0.56	0.73	-	-1.6	-1.8	EN
	10	27.66	27.61	27.79	1.03	1.01	-	6.1	6.6	EN
	11	27.94	27.91	27.85	1.41	1.35	-	15.8	8.7	EN
	12	28.09	28.03	27.90	1.55	1.49	-	-3.0	0.6	EN peak 1 (M)
1900	01	27.99	28.03	27.96	1.45	1.45	-	-7.3	-0.6	EN
	02	28.06	28.09	28.00	1.34	1.31	-	-6.5	-11.4	EN
	03	28.25	28.25	28.01	1.12	1.09	-	-25.3	-19.0	EN
	04	28.43	28.38	28.00	0.79	0.85	-	-18.7	-17.5	EN
	05	28.40	28.42	27.93	0.71	0.78	-	-7.4	-1.9	EN
	06	28.45	28.32	27.84	0.89	0.85	-	26.1	13.7	EN
	07	27.97	28.01	27.78	0.90	0.90	-	10.0	13.5	EN peak 2 (W)
	08	27.65	27.65	27.71	0.89	0.89	-	7.8	2.3	EN
	09	27.31	27.36	27.63	0.69	0.70	-	-16.6	-10.7	EN
	10	27.15	27.10	27.56	0.52	0.50	-	-17.2	-14.3	EN end
	11	26.79	26.98	27.50	0.26	0.42	-	-6.0	-8.7	
	12	27.19	27.14	27.42	0.65	0.61	-	-5.5	-4.3	
1901	01	27.40	27.26	27.34	0.86	0.68	-	-0.1	-0.7	
	02	27.06	27.21	27.25	0.34	0.43	-	3.0	3.8	
	03	27.30	27.33	27.16	0.17	0.17	-	9.4	6.6	
	04	27.64	27.57	27.10	0.00	0.04	-	4.5	4.5	
	05	27.68	27.61	27.04	-0.01	-0.04	-	-0.3	5.9	
	06	27.43	27.37	26.98	-0.13	-0.10	-	19.6	13.4	
	07	26.93	26.95	26.89	-0.14	-0.17	-	14.6	14.7	
	08	26.50	26.60	26.81	-0.26	-0.21	-	9.8	4.6	
	09	26.45	26.46	26.77	-0.17	-0.20	-	-16.0	-11.1	
	10	26.42	26.39	26.77	-0.21	-0.22	-	-22.1	-17.2	
	11	26.26	26.30	26.82	-0.27	-0.26	-	-8.6	-10.3	
	12	26.24	26.21	26.89	-0.30	-0.33	-	-1.9	1.2	
1902	01	26.08	26.23	27.00	-0.46	-0.36	-	17.0	7.5	
	02	26.50	26.52	27.14	-0.22	-0.26	-	-2.2	6.1	
	03	26.99	27.11	27.28	-0.14	-0.04	-	11.6	7.2	
	04	27.97	27.82	27.42	0.33	0.29	-	7.8	11.5	
	05	28.34	28.28	27.57	0.65	0.63	-	7.6	6.4	EN start
	06	28.45	28.48	27.73	0.89	1.01	-	2.6	3.6	EN
	07	28.67	28.47	27.87	1.60	1.36	-	1.6	-0.8	EN
	08	28.09	28.26	28.00	1.33	1.46	-	-8.9	-8.5	EN
	09	28.19	28.15	28.09	1.57	1.49	-	-17.8	-13.0	EN
	10	28.13	28.16	28.15	1.50	1.56	-	-7.4	-9.0	EN
	11	28.19	28.12	28.13	1.66	1.57	-	-3.4	-4.3	EN peak (S)
	12	27.98	28.02	28.08	1.44	1.48	-	-3.0	-4.7	EN

Table 7. SST monthly values of the Niño 3.4 region in degrees Celsius based on HadSST time series, ONI and SOI values, and the occurrences of EN (warm) and LN (cold) events from 1871 to the present (Continued).

Year	Mon	HadSST	2-mma	12-mma	D(m)	D(m <sup>2</sup> )	ONI	SOI*	SOI(2)	Comments**
1903	01	27.91	27.87	27.98	1.37	1.29	–	–9.2	–7.9	EN
	02	27.69	27.84	27.84	0.97	1.06	–	–10.2	–3.0	EN
	03	28.05	27.98	27.69	0.92	0.83	–	17.6	10.7	EN
	04	28.13	28.02	27.53	0.49	0.50	–	17.7	15.2	EN end
	05	27.77	27.91	27.36	0.08	0.27	–	7.6	8.1	
	06	27.98	27.62	27.16	0.42	0.15	–	–0.6	3.1	
	07	26.74	27.00	26.98	–0.33	–0.11	–	6.1	2.9	
	08	26.55	26.50	26.82	–0.21	–0.31	–	0.1	3.8	
	09	26.15	26.29	26.68	–0.47	–0.37	–	8.7	5.4	
	10	26.31	26.17	26.56	–0.32	–0.44	–	4.2	4.6	
	11	25.89	25.92	26.51	–0.64	–0.64	–	1.3	5.7	LN start
	12	25.57	25.72	26.49	–0.97	–0.82	–	15.9	11.8	LN peak (W)
1904	01	25.84	25.81	26.53	–0.70	–0.78	–	14.6	15.1	LN
	02	25.97	26.05	26.62	–0.75	–0.73	–	16.2	14.0	LN
	03	26.40	26.46	26.68	–0.73	–0.70	–	9.4	16.7	LN
	04	27.05	26.99	26.76	–0.59	–0.53	–	31.7	20.5	LN end
	05	27.47	27.46	26.86	–0.22	–0.19	–	9.2	10.8	
	06	27.83	27.78	26.97	0.27	0.31	–	–7.1	–3.5	
	07	27.98	27.80	27.11	0.91	0.69	–	–8.9	–6.0	
	08	27.42	27.40	27.23	0.66	0.59	–	0.8	–1.8	
	09	26.76	27.15	27.37	0.14	0.49	–	0.2	0.6	
	10	27.65	27.22	27.49	1.02	0.62	–	1.2	–3.7	EN start
	11	26.81	27.18	27.59	0.28	0.62	–	–17.2	–7.7	EN
	12	27.44	27.24	27.67	0.90	0.70	–	2.6	–5.3	EN
1905	01	27.26	27.36	27.69	0.72	0.78	–	–9.2	–8.2	EN
	02	27.48	27.60	27.72	0.76	0.82	–	–16.8	–18.3	EN peak 1 (W)
	03	28.18	27.98	27.80	1.05	0.82	–	–30.2	–30.0	EN peak 1 (W)
	04	28.06	28.31	27.86	0.42	0.79	–	–42.6	–38.2	EN
	05	28.94	28.56	27.90	1.25	0.91	–	–37.4	–37.2	EN
	06	28.28	28.39	27.94	0.72	0.92	–	–31.4	–30.4	EN
	07	28.05	28.08	27.96	0.98	0.96	–	–21.3	–20.4	EN
	08	27.92	28.02	27.97	1.16	1.22	–	–7.6	–10.9	EN
	09	28.18	28.03	27.96	1.56	1.38	–	–7.0	–6.8	EN peak 2 (M)
	10	27.85	27.84	27.96	1.22	1.24	–	–5.6	–9.0	EN
	11	27.48	27.64	27.93	0.95	1.09	–	–17.9	–13.6	EN
	12	27.76	27.62	27.86	1.22	1.08	–	–13.1	–11.9	EN
1906	01	27.47	27.54	27.79	0.93	0.95	–	–3.5	–6.9	EN
	02	27.44	27.60	27.68	0.72	0.83	–	–7.4	–5.9	EN
	03	28.06	27.95	27.52	0.93	0.79	–	–5.2	–6.7	EN
	04	28.22	28.10	27.35	0.58	0.57	–	–8.8	–5.4	EN end
	05	27.88	27.95	27.22	0.19	0.31	–	1.3	–2.5	
	06	27.83	27.57	27.10	0.27	0.10	–	–3.9	0.1	
	07	26.73	26.95	26.97	–0.34	–0.17	–	6.8	6.3	
	08	26.51	26.42	26.86	–0.25	–0.38	–	15.5	14.0	
	09	25.94	26.07	26.77	–0.68	–0.59	–	18.3	15.3	
	10	25.87	26.00	26.67	–0.76	–0.60	–	9.1	14.6	
	11	26.33	26.15	26.61	–0.20	–0.41	–	21.7	14.3	
	12	26.07	26.12	26.57	–0.47	–0.42	–	4.7	9.1	



Table 7. SST monthly values of the Niño 3.4 region in degrees Celsius based on HadSST time series, ONI and SOI values, and the occurrences of EN (warm) and LN (cold) events from 1871 to the present (Continued).

Year	Mon	HadSST	2-mma	12-mma	D(m)	D(m <sup>2</sup> )	ONI	SOI*	SOI(2)	Comments**
1907	01	26.01	26.11	26.54	-0.53	-0.47	-	5.1	4.1	
	02	26.36	26.39	26.53	-0.36	-0.39	-	1.6	2.0	
	03	26.83	26.81	26.56	-0.30	-0.35	-	-0.3	1.4	
	04	27.21	27.16	26.62	-0.43	-0.37	-	4.5	4.7	
	05	27.39	27.32	26.65	-0.30	-0.33	-	10.0	8.2	
	06	27.28	27.16	26.67	-0.28	-0.31	-	8.3	5.6	
	07	26.68	26.72	26.70	-0.39	-0.40	-	-4.3	-2.1	
	08	26.22	26.50	26.73	-0.54	-0.30	-	-8.2	-5.1	
	09	26.88	26.62	26.74	0.26	-0.04	-	0.2	-1.8	
	10	26.48	26.56	26.73	-0.15	-0.08	-	0.6	-0.2	
	11	26.40	26.44	26.73	-0.13	-0.12	-	-2.0	1.4	
	12	26.49	26.42	26.74	-0.05	-0.12	-	8.8	1.3	
1908	01	26.30	26.48	26.75	-0.24	-0.11	-	-10.6	-1.2	
	02	26.83	26.65	26.75	0.11	-0.13	-	7.7	1.3	
	03	26.63	26.83	26.74	-0.50	-0.33	-	0.2	6.2	
	04	27.22	27.12	26.70	-0.42	-0.41	-	16.8	8.2	
	05	27.41	27.38	26.66	-0.28	-0.27	-	-1.1	3.1	
	06	27.47	27.24	26.59	-0.09	-0.24	-	-2.3	-0.9	
	07	26.59	26.78	26.55	-0.48	-0.33	-	2.2	1.9	
	08	26.48	26.45	26.51	-0.28	-0.36	-	5.3	7.6	
	09	26.23	26.29	26.47	-0.39	-0.37	-	17.7	12.2	
	10	26.23	26.12	26.47	-0.40	-0.49	-	7.9	9.0	
	11	25.78	25.81	26.47	-0.75	-0.75	-	2.6	1.9	LN start
	12	25.43	25.73	26.44	-1.11	-0.81	-	-5.5	-2.7	LN peak (W)
1909	01	26.29	25.97	26.39	-0.25	-0.61	-	-2.5	-3.4	LN
	02	25.88	26.19	26.35	-0.84	-0.59	-	-3.2	-2.3	LN
	03	26.72	26.60	26.31	-0.41	-0.55	-	-0.3	-4.6	LN end
	04	27.09	27.10	26.26	-0.55	-0.43	-	-14.5	-6.8	
	05	27.50	27.17	26.21	-0.19	-0.48	-	2.1	3.1	
	06	26.59	26.73	26.18	-0.97	-0.75	-	22.8	14.6	LN start
	07	26.22	26.23	26.16	-0.85	-0.88	-	10.7	13.5	LN peak 1 (W)
	08	25.90	25.98	26.14	-0.86	-0.82	-	9.8	7.8	LN
	09	25.90	25.80	26.14	-0.72	-0.86	-	0.8	3.9	LN
	10	25.49	25.51	26.11	-1.14	-1.10	-	4.2	4.6	LN
	11	25.15	25.33	26.05	-1.38	-1.23	-	9.2	6.8	LN peak 2 (M)
	12	25.51	25.46	26.01	-1.03	-1.08	-	4.7	6.1	LN
1910	01	25.65	25.73	26.01	-0.89	-0.85	-	5.6	7.8	LN
	02	26.12	26.09	26.02	-0.60	-0.69	-	15.2	12.2	LN
	03	26.46	26.41	26.01	-0.67	-0.75	-	12.7	11.5	LN
	04	26.59	26.53	26.00	-1.05	-1.00	-	5.3	6.0	LN
	05	26.46	26.54	26.06	-1.23	-1.11	-	0.5	7.1	LN peak 3 (M)
	06	26.65	26.53	26.12	-0.91	-0.94	-	22.0	16.3	LN
	07	26.35	26.33	26.15	-0.72	-0.78	-	20.5	18.2	LN
	08	25.98	25.94	26.17	-0.78	-0.86	-	9.8	13.9	LN
	09	25.46	25.68	26.17	-1.16	-0.98	-	15.3	12.7	LN peak 4 (W)
	10	25.80	25.80	26.17	-0.83	-0.81	-	10.3	13.9	LN
	11	26.13	26.00	26.19	-0.40	-0.56	-	19.7	16.4	LN
	12	25.95	26.01	26.22	-0.59	-0.53	-	15.9	13.7	LN

Table 7. SST monthly values of the Niño 3.4 region in degrees Celsius based on HadSST time series, ONI and SOI values, and the occurrences of EN (warm) and LN (cold) events from 1871 to the present (Continued).

Year	Mon	HadSST	2-mma	12-mma	D(m)	D(m <sup>2</sup> )	ONI	SOI*	SOI(2)	Comments**
1911	01	26.01	26.04	26.26	-0.53	-0.55	-	3.2	6.0	LN
	02	26.18	26.20	26.32	-0.54	-0.58	-	1.6	2.5	LN
	03	26.44	26.43	26.40	-0.69	-0.73	-	3.5	2.7	LN
	04	26.66	26.65	26.51	-0.98	-0.88	-	2.0	-0.2	LN peak 5 (W)
	05	26.82	26.84	26.62	-0.87	-0.81	-	-8.2	-10.3	LN end
	06	27.05	26.98	26.74	-0.51	-0.49	-	-12.0	-11.3	
	07	27.01	26.92	26.90	-0.06	-0.20	-	-12.8	-12.4	
	08	26.59	26.79	27.04	-0.17	-0.01	-	-12.1	-11.5	
	09	26.97	26.87	27.17	0.35	0.21	-	-8.8	-10.4	
	10	26.93	27.08	27.30	0.30	0.48	-	-11.7	-9.9	
	11	27.50	27.37	27.41	0.97	0.81	-	-7.3	-6.9	EN start
	12	27.55	27.68	27.47	1.01	1.15	-	-1.4	-5.0	EN
1912	01	28.13	27.85	27.49	1.59	1.27	-	-9.7	-9.5	EN peak (M)
	02	27.59	27.82	27.49	0.87	1.04	-	-17.3	-13.3	EN
	03	27.95	27.96	27.49	0.82	0.81	-	-9.0	-14.1	EN
	04	28.35	28.13	27.47	0.71	0.61	-	-21.1	-16.1	EN end
	05	27.87	27.88	27.42	0.18	0.24	-	-13.0	-13.4	
	06	27.44	27.47	27.34	-0.12	0.00	-	-6.3	-6.5	
	07	27.12	27.04	27.20	0.05	-0.08	-	-0.4	-3.7	
	08	26.48	26.73	27.10	-0.28	-0.07	-	-7.6	-4.9	
	09	26.85	26.70	27.05	0.23	0.04	-	-4.0	-5.9	
	10	26.60	26.72	26.97	-0.03	0.12	-	-8.0	-4.4	
	11	26.82	26.59	26.91	0.29	0.03	-	2.6	-2.7	
	12	26.10	26.35	26.90	-0.44	-0.19	-	-8.0	-4.2	
1913	01	26.38	26.45	26.90	-0.16	-0.14	-	-3.5	-5.0	
	02	26.94	26.92	26.91	0.22	0.14	-	-5.0	-3.1	
	03	27.42	27.20	26.92	0.29	0.04	-	1.3	-2.2	
	04	27.00	27.25	26.93	-0.64	-0.28	-	-6.3	-4.9	
	05	27.58	27.42	26.96	-0.11	-0.22	-	-8.2	-6.7	
	06	27.53	27.43	27.04	-0.03	-0.04	-	-3.9	-4.4	
	07	27.08	27.12	27.13	0.01	0.01	-	-1.7	-3.7	
	08	26.79	26.87	27.20	0.03	0.06	-	-7.6	-6.6	
	09	26.80	26.79	27.23	0.18	0.13	-	-9.4	-8.9	
	10	26.76	26.94	27.30	0.13	0.34	-	-9.2	-9.9	
	11	27.45	27.27	27.37	0.92	0.72	-	-11.9	-10.0	EN start
	12	27.43	27.40	27.39	0.89	0.86	-	-7.0	-7.8	EN peak (W)
1914	01	27.28	27.39	27.43	0.74	0.80	-	-5.4	-4.0	EN
	02	27.56	27.50	27.50	0.84	0.72	-	2.0	2.0	EN
	03	27.58	27.80	25.57	0.45	0.64	-	9.4	1.6	EN
	04	28.46	28.09	27.60	0.82	0.57	-	-14.5	-5.0	EN end
	05	27.87	27.99	27.59	0.18	0.35	-	-0.3	-8.0	
	06	27.77	27.79	27.57	0.21	0.32	-	-16.8	-13.0	
	07	27.75	27.77	27.57	0.68	0.65	-	-18.0	-17.5	
	08	27.80	27.70	27.57	1.04	0.89	-	-17.2	-16.2	
	09	27.43	27.41	27.57	0.81	0.76	-	-12.4	-12.7	
	10	26.99	27.09	27.57	0.36	0.49	-	-8.6	-10.4	
	11	26.96	27.05	27.58	0.43	0.49	-	-11.9	-8.5	
	12	27.27	27.42	27.64	0.73	0.70	-	-1.4	-9.1	EN start

Table 7. SST monthly values of the Niño 3.4 region in degrees Celsius based on HadSST time series, ONI and SOI values, and the occurrences of EN (warm) and LN (cold) events from 1871 to the present (Continued).

Year	Mon	HadSST	2-mma	12-mma	D(m)	D(m <sup>2</sup> )	ONI	SOI*	SOI(2)	Comments**
1915	01	27.46	27.40	27.67	0.92	0.82	–	–21.6	–11.7	EN peak 1 (W)
	02	27.41	27.51	27.61	0.69	0.73	–	–2.2	–11.6	EN
	03	27.75	27.79	27.55	0.62	0.63	–	–20.4	–15.2	EN
	04	28.24	28.15	27.53	0.60	0.63	–	–17.8	–17.1	EN
	05	28.38	28.45	27.51	0.69	0.80	–	–12.2	–8.9	EN
	06	28.78	28.31	27.45	1.22	0.84	–	6.6	3.8	EN peak 2 (W) end
	07	27.29	27.57	27.38	0.22	0.46	–	14.0	10.5	
	08	26.93	27.02	27.28	0.17	0.22	–	7.2	9.0	
	09	26.92	26.94	27.19	0.30	0.28	–	7.5	6.2	
	10	26.97	26.84	27.10	0.34	0.23	–	2.4	–0.6	
	11	26.51	26.59	27.02	–0.02	0.03	–	–14.6	–4.3	
	12	26.36	26.42	26.93	–0.18	–0.12	–	9.8	2.7	
1916	01	26.46	26.36	26.82	–0.08	–0.23	–	5.6	4.4	
	02	26.16	26.38	26.71	–0.56	–0.40	–	–3.6	–2.0	
	03	26.72	26.69	26.58	–0.41	–0.47	–	–6.3	–4.2	
	04	27.14	27.16	26.45	–0.50	–0.37	–	–0.5	–0.1	
	05	27.64	27.44	26.32	–0.05	–0.21	–	6.8	5.6	
	06	27.32	27.10	26.19	–0.24	–0.37	–	9.1	12.7	
	07	26.12	26.24	26.07	–0.95	–0.88	–	25.7	19.2	LN start
	08	25.39	25.57	25.99	–1.37	–1.23	–	16.2	15.7	LN
	09	25.39	25.39	25.96	–1.23	–1.27	–	4.5	7.8	LN
	10	25.37	25.27	25.97	–1.26	–1.34	–	6.1	6.6	LN
	11	24.93	25.05	25.98	–1.60	–1.51	–	9.8	10.3	LN
	12	24.95	24.96	25.99	–1.59	–1.58	–	15.4	11.4	LN peak (S)
1917	01	25.02	25.14	26.05	–1.52	–1.45	–	5.1	8.9	LN
	02	25.56	25.69	26.16	–1.16	–1.09	–	10.0	6.6	LN
	03	26.62	26.57	26.29	–0.51	–0.59	–	18.1	17.0	LN end
	04	27.48	27.29	26.40	–0.16	–0.24	–	21.8	20.9	
	05	27.57	27.57	26.51	–0.12	–0.08	–	21.8	21.7	
	06	27.65	27.51	26.60	0.09	0.04	–	21.2	23.1	
	07	27.18	27.26	26.67	0.11	0.15	–	28.3	28.2	
	08	27.03	26.99	26.72	0.27	0.19	–	34.8	31.9	
	09	26.73	26.82	26.72	0.11	0.16	–	29.7	27.4	
	10	26.77	26.63	26.70	0.14	0.02	–	15.2	20.3	
	11	26.23	26.28	26.69	–0.30	–0.28	–	21.0	19.9	
	12	25.87	25.93	26.71	–0.67	–0.61	–	22.5	20.2	
1918	01	25.74	25.82	26.73	–0.80	–0.76	–	14.6	17.1	
	02	25.94	25.98	26.73	–0.78	–0.80	–	16.6	11.5	
	03	26.30	26.44	26.74	–0.83	–0.72	–	–2.0	7.4	
	04	27.21	27.11	26.80	–0.43	–0.42	–	16.8	12.1	
	05	27.70	27.67	26.90	0.01	–0.09	–	10.0	8.0	
	06	28.06	27.74	27.06	0.05	0.05	–	–4.7	–3.4	
	07	27.15	27.34	27.24	0.08	0.11	–	–14.1	–9.3	
	08	27.00	27.08	27.43	0.24	0.28	–	–4.4	–5.8	
	09	27.16	27.25	27.59	0.54	0.59	–	–8.2	–6.5	EN start
	10	27.66	27.59	27.72	1.03	0.99	–	–5.0	–4.2	EN
	11	27.89	27.83	27.81	1.36	1.28	–	1.3	–2.6	EN
	12	27.89	27.96	27.85	1.35	1.43	–	–8.0	–7.4	EN

Table 7. SST monthly values of the Niño 3.4 region in degrees Celsius based on HadSST time series, ONI and SOI values, and the occurrences of EN (warm) and LN (cold) events from 1871 to the present (Continued).

Year	Mon	HadSST	2-mma	12-mma	D(m)	D(m <sup>2</sup> )	ONI	SOI*	SOI(2)	Comments**
1919	01	28.18	28.06	27.88	1.64	1.48	–	–14.9	–12.3	EN peak 1 (M)
	02	28.00	28.09	27.92	1.28	1.31	–	–11.2	–12.5	EN
	03	28.16	28.20	27.95	1.03	1.04	–	–12.8	–10.0	EN
	04	28.46	28.39	27.92	0.82	0.87	–	–3.0	–6.6	EN
	05	28.49	28.43	27.82	0.80	0.79	–	–7.4	–7.1	EN
	06	28.29	28.18	27.71	0.73	0.71	–	–10.4	–9.3	EN
	07	27.63	27.76	27.63	0.56	0.65	–	–8.9	–8.8	EN
	08	27.50	27.47	27.57	0.74	0.67	–	–6.9	–7.1	EN peak 2 (W)
	09	27.26	27.22	27.52	0.64	0.57	–	–5.8	–7.3	EN end
	10	26.87	26.82	27.47	0.24	0.22	–	–10.5	–9.5	
	11	26.29	26.60	27.40	–0.24	0.04	–	–11.3	–10.6	
	12	26.93	26.84	27.36	0.39	0.31	–	–9.1	–6.9	
1920	01	27.22	27.19	27.33	0.68	0.60	–	1.8	–1.8	
	02	27.37	27.44	27.30	0.65	0.66	–	–1.7	–1.4	
	03	27.79	27.64	27.27	0.66	0.49	–	–4.1	–2.4	
	04	27.61	27.67	27.27	–0.03	0.14	–	0.3	–1.6	
	05	27.66	27.73	27.30	–0.03	0.08	–	–2.7	0.4	
	06	27.98	27.75	27.30	0.42	0.28	–	6.6	5.0	
	07	27.37	27.43	27.27	0.30	0.32	–	9.4	7.7	
	08	27.01	27.10	27.22	0.25	0.30	–	5.3	6.3	
	09	27.02	27.07	27.09	0.40	0.41	–	5.1	2.8	
	10	27.22	27.01	26.99	0.59	0.41	–	–4.3	–0.9	
	11	26.57	26.73	26.95	0.04	0.18	–	–0.1	1.3	
	12	26.57	26.68	26.90	0.03	0.14	–	9.8	7.6	
1921	01	27.01	26.71	26.86	0.47	0.13	–	10.8	9.5	
	02	26.25	26.34	26.82	–0.47	–0.44	–	6.7	8.3	
	03	25.84	26.29	26.79	–1.29	–0.87	–	8.9	4.4	
	04	27.22	26.81	26.75	–0.42	–0.72	–	–7.1	–0.8	
	05	26.94	27.14	26.69	–0.75	–0.50	–	2.1	4.8	
	06	27.47	27.21	26.63	–0.09	–0.26	–	22.0	12.3	
	07	26.95	26.99	26.57	–0.12	–0.13	–	2.9	5.2	
	08	26.59	26.68	26.55	–0.17	–0.13	–	–6.9	–1.5	
	09	26.58	26.63	26.63	–0.04	–0.03	–	5.1	3.3	
	10	26.77	26.44	26.69	0.14	–0.17	–	9.7	8.3	
	11	25.62	26.03	26.74	–0.91	–0.53	–	8.5	8.7	
	12	26.09	25.96	26.78	–0.45	–0.58	–	8.2	8.2	
1922	01	26.04	26.22	26.76	–0.50	–0.37	–	8.0	8.3	
	02	26.69	26.69	26.73	–0.03	–0.09	–	9.1	8.0	
	03	27.33	27.15	26.71	0.20	–0.01	–	5.6	3.7	
	04	27.23	27.47	26.68	–0.41	–0.06	–	–5.5	–2.6	
	05	28.09	27.67	26.70	0.40	0.02	–	–5.1	–2.5	
	06	27.25	27.34	26.73	–0.31	–0.13	–	5.8	2.2	
	07	26.78	26.73	26.74	–0.29	–0.39	–	2.2	2.3	
	08	26.09	26.34	26.71	–0.67	–0.47	–	–1.2	1.2	
	09	26.38	26.33	26.65	–0.24	–0.33	–	5.1	3.8	
	10	26.48	26.42	26.61	–0.15	–0.18	–	6.1	6.5	
	11	26.34	26.31	26.59	–0.19	–0.25	–	8.5	8.7	
	12	26.06	26.16	26.58	–0.48	–0.38	–	11.8	9.4	

Table 7. SST monthly values of the Niño 3.4 region in degrees Celsius based on HadSST time series, ONI and SOI values, and the occurrences of EN (warm) and LN (cold) events from 1871 to the present (Continued).

Year	Mon	HadSST	2-mma	12-mma	D(m)	D(m <sup>2</sup> )	ONI	SOI*	SOI(2)	Comments**
1923	01	26.17	26.10	26.02	-0.37	-0.49	-	5.6	6.9	
	02	26.00	26.15	26.65	-0.72	-0.63	-	4.4	5.8	
	03	26.41	26.51	26.74	-0.72	-0.65	-	8.9	7.7	
	04	27.22	27.12	26.82	-0.42	-0.41	-	8.6	7.1	
	05	27.62	27.50	26.91	-0.07	-0.15	-	2.1	3.5	
	06	27.54	27.43	27.03	-0.02	-0.04	-	1.0	-1.9	
	07	27.03	27.17	27.13	-0.04	0.05	-	-11.5	-10.1	
	08	27.07	27.14	27.22	0.31	0.34	-	-18.5	-15.8	
	09	27.40	27.35	27.33	0.78	0.69	-	-14.8	-13.6	EN start
	10	27.52	27.49	27.41	0.89	0.89	-	-6.2	-10.0	EN
	11	27.52	27.50	27.40	0.99	0.98	-	-12.6	-7.3	EN peak (W)
	12	27.60	27.44	27.36	1.06	0.90	-	2.1	-3.5	EN
1924	01	27.04	27.27	27.30	0.50	0.68	-	-5.4	-1.9	EN
	02	27.39	27.37	27.23	0.67	0.59	-	1.1	-0.2	EN end
	03	27.65	27.61	27.12	0.52	0.46	-	2.4	-2.4	
	04	27.75	27.54	27.01	0.11	0.02	-	-15.4	-4.2	
	05	27.02	27.20	26.88	-0.67	-0.44	-	11.5	4.0	
	06	27.02	26.83	26.73	-0.54	-0.64	-	8.3	8.9	LN start
	07	26.25	26.40	26.59	-0.82	-0.71	-	7.4	8.4	LN
	08	26.09	26.08	26.49	-0.67	-0.72	-	10.4	9.1	LN peak 1 (W)
	09	25.89	26.04	26.40	-0.73	-0.62	-	8.1	8.6	LN
	10	26.28	26.00	26.34	-0.35	-0.60	-	7.9	8.9	LN
	11	25.56	25.83	26.34	-0.97	-0.73	-	11.8	9.2	LN
	12	25.93	25.74	26.38	-0.61	-0.80	-	5.2	7.0	LN peak 2 (W)
1925	01	25.55	25.83	26.46	-0.99	-0.76	-	5.6	7.6	LN
	02	26.29	26.22	26.58	-0.43	-0.56	-	13.8	12.0	LN end
	03	26.73	26.75	26.71	-0.40	-0.41	-	14.9	14.5	
	04	27.25	27.18	26.84	-0.39	-0.35	-	14.4	10.7	
	05	27.47	27.43	26.98	-0.22	-0.22	-	-1.1	1.9	
	06	27.51	27.56	27.16	-0.05	0.09	-	-4.7	-6.0	
	07	27.73	27.63	27.36	0.66	0.52	-	-13.4	-10.6	EN start
	08	27.55	27.59	27.54	0.79	0.79	-	-10.8	-10.4	EN
	09	27.52	27.54	27.68	0.90	0.89	-	-6.4	-9.1	EN
	10	27.58	27.59	27.82	0.95	0.98	-	-12.9	-10.4	EN
	11	27.66	27.77	27.93	1.13	1.22	-	-9.3	-9.6	EN
	12	28.19	28.04	28.02	1.65	1.50	-	-7.0	-7.2	EN
1926	01	28.10	28.11	28.05	1.56	1.53	-	-5.4	-8.1	EN peak (S)
	02	28.06	28.17	28.04	1.34	1.39	-	-14.5	-11.9	EN
	03	28.44	28.43	27.98	1.31	1.28	-	-13.3	-12.1	EN
	04	28.78	28.67	27.90	1.14	1.15	-	-7.1	-7.6	EN
	05	28.69	28.61	27.79	1.00	0.97	-	-2.7	-4.9	EN
	06	28.29	28.28	27.66	0.73	0.81	-	-7.1	-4.5	EN
	07	27.86	27.76	27.53	0.79	0.65	-	-1.0	-4.2	EN end
	08	27.03	27.15	27.42	0.27	0.37	-	-7.6	-3.7	
	09	26.68	26.68	27.32	0.06	0.03	-	1.4	-0.2	
	10	26.34	26.44	27.21	-0.29	-0.17	-	4.2	2.8	
	11	26.38	26.37	27.10	-0.15	-0.19	-	1.3	3.3	
	12	26.36	26.45	27.01	-0.18	-0.09	-	6.2	4.7	

Table 7. SST monthly values of the Niño 3.4 region in degrees Celsius based on HadSST time series, ONI and SOI values, and the occurrences of EN (warm) and LN (cold) events from 1871 to the present (Continued).

Year	Mon	HadSST	2-mma	12-mma	D(m)	D(m <sup>2</sup> )	ONI	SOI*	SOI(2)	Comments**
1927	01	26.68	26.68	26.94	0.14	0.10	–	5.1	4.4	
	02	27.00	26.94	26.89	0.28	0.16	–	1.1	6.4	
	03	27.08	27.17	26.88	–0.05	0.01	–	18.1	11.1	
	04	27.50	27.34	26.90	–0.14	–0.19	–	6.9	9.5	
	05	27.28	27.40	26.94	–0.41	–0.25	–	6.0	6.8	
	06	27.54	27.32	26.97	–0.02	–0.15	–	8.3	7.2	
	07	26.92	27.04	27.00	–0.15	–0.08	–	6.1	3.9	
	08	26.78	26.77	27.02	0.02	–0.03	–	–5.0	–1.1	
	09	26.60	26.75	27.01	–0.02	0.09	–	–0.4	–2.5	
	10	27.00	26.80	27.01	0.37	0.20	–	–4.3	–4.3	
	11	26.61	26.77	27.04	0.08	0.21	–	–8.0	–3.2	
	12	26.84	26.84	27.05	0.30	0.30	–	7.7	–0.7	
1928	01	27.05	26.98	27.06	0.51	0.39	–	–10.1	–0.5	
	02	26.97	27.00	27.07	0.25	0.22	–	10.5	6.2	
	03	27.01	27.14	27.06	–0.12	–0.02	–	13.8	12.5	
	04	27.55	27.49	27.05	–0.09	–0.04	–	11.9	8.7	
	05	27.83	27.66	27.03	0.14	0.02	–	–2.7	–0.4	
	06	27.43	27.49	27.01	–0.13	0.02	–	–7.9	–4.7	
	07	27.25	27.13	26.97	0.18	0.02	–	–0.4	0.3	
	08	26.59	26.76	26.93	–0.17	–0.04	–	9.8	6.8	
	09	26.62	26.61	26.93	0.00	–0.05	–	8.1	8.8	
	10	26.61	26.58	26.93	–0.02	–0.02	–	9.1	7.2	
	11	26.49	26.54	26.93	–0.04	–0.02	–	2.6	6.5	
	12	26.56	26.51	26.94	0.02	–0.03	–	11.8	10.6	
1929	01	26.43	26.53	26.86	–0.11	–0.06	–	16.0	15.5	
	02	26.69	26.73	26.97	–0.03	–0.04	–	18.0	14.3	
	03	27.11	27.13	27.00	–0.02	–0.02	–	5.1	8.2	
	04	27.62	27.51	27.04	–0.02	–0.01	–	4.5	0.5	
	05	27.70	27.71	27.08	0.01	0.06	–	–12.2	–4.7	
	06	27.81	27.63	27.12	0.25	0.16	–	1.0	–2.2	
	07	27.21	27.30	27.17	0.14	0.19	–	1.6	1.1	
	08	26.98	27.06	27.21	0.22	0.25	–	0.1	0.4	
	09	27.05	27.05	27.25	0.43	0.40	–	–0.4	1.8	
	10	27.13	27.04	27.29	0.50	0.44	–	7.9	6.6	
	11	26.84	27.01	27.32	0.31	0.45	–	11.1	9.0	
	12	27.22	27.05	27.33	0.68	0.52	–	5.7	8.8	
1930	01	26.93	27.06	27.36	0.39	0.47	–	12.7	9.7	
	02	27.15	27.20	27.41	0.43	0.42	–	7.7	7.5	
	03	27.55	27.61	27.48	0.42	0.45	–	1.8	1.9	
	04	28.18	27.94	27.55	0.54	0.41	–	–3.8	–0.9	
	05	27.83	27.95	27.65	0.14	0.30	–	2.1	–1.3	
	06	27.95	27.90	27.75	0.39	0.43	–	–5.5	–3.3	
	07	27.86	27.81	27.83	0.79	0.69	–	–4.3	–4.0	EN start
	08	27.56	27.76	27.91	0.80	0.95	–	–1.8	–3.7	EN
	09	28.04	27.88	27.99	1.42	1.22	–	–7.0	–3.1	EN
	10	27.87	28.06	28.05	1.24	1.45	–	3.6	0.5	EN
	11	28.44	28.19	28.10	1.91	1.63	–	1.9	1.5	EN peak (S)
	12	28.00	28.13	28.14	1.46	1.59	–	–1.4	1.5	EN

Table 7. SST monthly values of the Niño 3.4 region in degrees Celsius based on HadSST time series, ONI and SOI values, and the occurrences of EN (warm) and LN (cold) events from 1871 to the present (Continued).

Year	Mon	HadSST	2-mma	12-mma	D(m)	D(m <sup>2</sup> )	ONI	SOI*	SOI(2)	Comments**
1931	01	28.07	28.06	28.14	1.53	1.48	–	7.0	–0.6	EN
	02	28.10	28.18	28.11	1.38	1.40	–	–14.9	–4.3	EN
	03	28.44	28.43	28.01	1.31	1.27	–	5.6	1.2	EN
	04	28.73	28.60	27.88	1.09	1.07	–	8.6	9.0	EN
	05	28.49	28.47	27.74	0.80	0.82	–	13.1	13.4	EN
	06	28.16	28.11	27.58	0.60	0.64	–	18.8	15.0	EN
	07	27.63	27.61	27.43	0.56	0.50	–	9.4	9.4	EN end
	08	27.02	27.00	27.29	0.26	0.20	–	0.1	3.7	
	09	26.33	26.55	27.19	–0.29	–0.11	–	5.1	–0.7	
	10	26.51	26.43	27.12	–0.12	–0.17	–	–12.9	–6.4	
	11	26.38	26.40	27.08	–0.15	–0.16	–	–4.7	–4.4	
	12	26.31	26.29	27.05	–0.23	–0.25	–	4.7	1.6	
1932	01	26.16	26.30	27.02	–0.38	–0.29	–	1.8	1.2	
	02	26.57	26.70	26.99	–0.15	–0.08	–	–3.6	–2.0	
	03	27.51	27.40	27.01	0.38	0.25	–	–2.5	–2.7	
	04	28.02	27.92	27.04	0.38	0.40	–	–2.1	–1.0	
	05	28.14	28.04	27.06	0.45	0.40	–	2.8	–0.3	
	06	27.87	27.75	27.06	0.31	0.28	–	–4.7	–2.9	
	07	27.11	27.27	27.06	0.04	0.15	–	–5.0	–5.4	
	08	26.97	26.96	27.08	0.21	0.15	–	–6.9	–6.9	
	09	26.77	26.82	27.06	0.15	0.16	–	–8.8	–7.2	
	10	26.75	26.72	27.03	0.12	0.12	–	–4.3	–5.5	
	11	26.61	26.54	26.99	0.08	–0.02	–	–4.7	–2.6	
	12	26.18	26.33	26.92	–0.36	–0.21	–	3.2	–2.4	
1933	01	26.36	26.40	26.86	–0.18	–0.19	–	–11.1	–3.5	
	02	26.68	26.69	26.79	–0.04	–0.09	–	4.9	–0.8	
	03	27.05	27.14	26.71	–0.08	–0.02	–	–2.0	1.1	
	04	27.78	27.52	26.63	0.14	–0.01	–	3.6	2.8	
	05	27.46	27.38	26.55	–0.23	–0.26	–	6.0	2.9	
	06	26.83	26.92	26.47	–0.73	–0.55	–	–3.9	0.4	LN start
	07	26.56	26.47	26.41	–0.51	–0.65	–	3.5	0.7	LN
	08	25.93	26.10	26.34	–0.83	–0.70	–	–0.5	1.1	LN
	09	25.98	25.88	26.28	–0.64	–0.78	–	2.0	1.8	LN
	10	25.63	25.71	26.23	–1.00	–0.90	–	3.6	4.1	LN
	11	25.59	25.55	26.21	–0.94	–1.01	–	7.2	6.6	LN
	12	25.38	25.50	26.23	–1.16	–1.04	–	8.2	7.5	LN peak (M)
1934	01	25.64	25.64	26.26	–0.90	–0.95	–	6.5	5.3	LN
	02	25.89	25.93	26.29	–0.83	–0.85	–	0.1	1.7	LN
	03	26.31	26.47	26.33	–0.82	–0.69	–	0.2	1.7	LN end
	04	27.35	27.10	26.38	–0.29	–0.43	–	6.1	1.3	
	05	27.37	27.36	26.45	–0.32	–0.29	–	–7.4	0.5	
	06	27.35	27.22	26.53	–0.21	–0.25	–	10.7	4.2	
	07	26.80	26.88	26.60	–0.27	–0.24	–	2.9	–1.6	
	08	26.55	26.53	26.65	–0.21	–0.27	–	–22.4	–12.3	
	09	26.23	26.37	26.71	–0.39	–0.29	–	–6.4	–7.9	
	10	26.48	26.43	26.74	–0.15	–0.17	–	4.2	3.8	
	11	26.54	26.48	26.74	0.01	–0.08	–	13.1	7.0	
	12	26.34	26.37	26.74	–0.20	–0.17	–	–2.4	3.7	

Table 7. SST monthly values of the Niño 3.4 region in degrees Celsius based on HadSST time series, ONI and SOI values, and the occurrences of EN (warm) and LN (cold) events from 1871 to the present (Continued).

Year	Mon	HadSST	2-mma	12-mma	D(m)	D(m <sup>2</sup> )	ONI	SOI*	SOI(2)	Comments**
1935	01	26.26	26.36	26.72	-0.28	-0.23	-	6.5	1.5	
	02	26.57	26.60	26.73	-0.15	-0.18	-	-4.6	2.4	
	03	26.98	27.00	26.77	-0.15	-0.16	-	12.2	5.7	
	04	27.45	27.30	26.82	-0.19	-0.23	-	2.8	2.8	
	05	27.32	27.34	26.86	-0.37	-0.30	-	-6.6	-3.2	
	06	27.28	27.12	26.88	-0.28	-0.36	-	-2.3	-2.9	
	07	26.58	26.84	26.94	-0.49	-0.27	-	-0.4	-0.3	
	08	26.93	26.82	27.01	0.17	0.02	-	2.1	2.5	
	09	26.83	26.90	27.05	0.21	0.24	-	6.3	5.5	
	10	27.01	26.95	27.09	0.38	0.35	-	7.3	6.2	
	11	26.94	26.86	27.13	0.41	0.30	-	3.9	2.8	
	12	26.55	26.84	27.15	0.01	0.30	-	-4.0	-1.5	
1936	01	27.32	27.11	27.17	0.78	0.53	-	-2.0	-1.9	
	02	27.25	27.27	27.16	0.53	0.49	-	0.6	0.3	
	03	27.26	27.46	27.14	0.13	0.30	-	1.8	6.7	
	04	28.06	27.80	27.14	0.42	0.27	-	22.6	12.9	
	05	27.80	27.75	27.13	0.11	0.10	-	4.4	7.5	
	06	27.33	27.34	27.14	-0.23	-0.14	-	-1.5	1.4	
	07	26.88	26.91	27.13	-0.19	-0.21	-	4.2	-0.5	
	08	26.55	26.66	27.08	-0.21	-0.15	-	-8.9	-2.8	
	09	26.65	26.74	27.08	0.03	0.09	-	2.6	-1.0	
	10	27.12	26.88	27.09	0.49	0.28	-	-0.1	-2.9	
	11	26.62	26.90	27.07	0.09	0.34	-	-13.9	-6.8	
	12	27.22	26.83	27.06	0.68	0.30	-	0.6	-0.8	
1937	01	26.27	26.71	27.08	-0.27	0.12	-	9.4	3.6	
	02	27.06	26.98	27.10	0.34	0.20	-	-5.0	1.4	
	03	27.51	27.52	27.12	0.38	0.36	-	6.2	2.4	
	04	27.98	27.73	27.11	0.34	0.20	-	2.0	2.5	
	05	27.44	27.56	27.10	-0.25	-0.08	-	-0.3	1.2	
	06	27.39	27.39	27.09	-0.17	-0.09	-	3.4	0.2	
	07	27.32	27.18	27.08	0.25	0.06	-	-5.6	-1.1	
	08	26.67	26.90	27.08	-0.09	0.10	-	3.3	0.5	
	09	26.93	26.79	27.06	0.31	0.14	-	0.8	-1.1	
	10	26.63	26.77	27.04	0.00	0.16	-	-2.5	-1.6	
	11	26.87	26.79	27.04	0.34	0.24	-	-2.0	0.1	
	12	26.80	26.71	27.02	0.26	0.17	-	6.7	4.7	
1938	01	26.37	26.63	26.95	-0.17	0.05	-	7.5	6.3	
	02	26.99	26.89	26.88	0.27	0.11	-	3.4	2.7	
	03	27.20	27.31	26.84	0.07	0.16	-	-3.6	-0.1	
	04	27.86	27.61	26.79	0.22	0.09	-	3.6	4.2	
	05	27.53	27.43	26.73	-0.16	-0.22	-	13.1	12.0	
	06	26.80	26.84	26.64	-0.76	-0.63	-	18.0	16.9	
	07	26.24	26.34	26.58	-0.83	-0.78	-	18.5	17.0	
	08	26.07	26.21	26.52	-0.69	-0.59	-	13.0	13.0	
	09	26.47	26.25	26.43	-0.15	-0.41	-	7.5	10.2	
	10	25.98	26.09	26.39	-0.65	-0.51	-	12.8	8.8	LN start
	11	25.93	25.91	26.37	-0.60	-0.65	-	1.9	7.6	LN
	12	25.79	25.86	26.42	-0.75	-0.68	-	13.8	11.6	LN



Table 7. SST monthly values of the Niño 3.4 region in degrees Celsius based on HadSST time series, ONI and SOI values, and the occurrences of EN (warm) and LN (cold) events from 1871 to the present (Continued).

Year	Mon	HadSST	2-mma	12-mma	D(m)	D(m <sup>2</sup> )	ONI	SOI*	SOI(2)	Comments**
1939	01	25.91	25.86	26.51	-0.63	-0.73	-	17.0	13.9	LN
	02	25.81	25.99	26.59	-0.91	-0.79	-	7.7	11.0	LN peak (W)
	03	26.41	26.53	26.66	-0.72	-0.62	-	11.6	10.1	LN end
	04	27.50	27.26	26.70	-0.14	-0.27	-	9.4	7.3	
	05	27.61	27.62	26.76	-0.08	-0.03	-	-1.1	1.4	
	06	27.74	27.64	26.84	0.18	0.17	-	-1.5	1.0	
	07	27.48	27.41	26.95	0.41	0.30	-	8.1	3.6	
	08	26.94	27.14	27.12	0.18	0.34	-	-0.5	-4.6	
	09	27.19	26.90	27.31	0.57	0.24	-	-9.4	-8.5	
	10	26.27	26.68	27.44	-0.36	0.08	-	-14.7	-11.7	
	11	26.98	26.72	27.51	0.45	0.16	-	-8.0	-9.8	
	12	26.64	27.01	27.55	0.10	0.42	-	-8.6	-6.3	
1940	01	27.76	27.58	27.57	1.22	0.99	-	-0.1	-3.2	EN start
	02	28.14	28.12	27.60	1.42	1.34	-	-4.1	-4.7	EN peak 1 (M)
	03	28.44	28.40	27.61	1.31	1.24	-	-10.6	-8.7	EN
	04	28.57	28.45	27.63	0.93	0.92	-	-9.6	-11.1	EN
	05	28.21	28.31	27.67	0.52	0.66	-	-14.5	-14.5	EN
	06	28.24	28.03	27.75	0.68	0.56	-	-19.3	-17.1	EN
	07	27.43	27.68	27.81	0.36	0.57	-	-15.4	-17.2	EN peak 2 (W)
	08	27.63	27.37	27.82	0.87	0.57	-	-18.5	-18.0	EN peak 2 (W) end
	09	26.80	27.07	27.82	0.18	0.42	-	-19.6	-19.0	
	10	27.06	27.07	27.86	0.43	0.47	-	-18.4	-15.8	
	11	27.35	27.44	27.92	0.82	0.88	-	-6.7	-15.3	EN start
	12	27.98	27.82	27.97	1.44	1.28	-	-29.4	-18.8	EN
1941	01	27.95	28.00	28.01	1.41	1.41	-	-9.7	-16.1	EN
	02	28.11	28.21	28.03	1.39	1.43	-	-15.4	-12.8	EN
	03	28.67	28.65	28.06	1.54	1.49	-	-10.6	-12.0	EN
	04	29.13	29.03	28.11	1.49	1.50	-	-11.2	-9.9	EN peak 1 (S)
	05	29.18	29.02	28.16	1.49	1.37	-	-6.6	-9.7	EN
	06	28.57	28.57	28.18	1.01	1.10	-	-14.4	-14.0	EN
	07	27.95	28.03	28.14	0.88	0.92	-	-20.6	-18.7	EN
	08	27.66	27.68	28.07	0.90	0.87	-	-19.1	-16.8	EN
	09	27.43	27.56	27.99	0.81	0.90	-	-8.2	-13.9	EN
	10	27.72	27.68	27.91	1.09	1.07	-	-20.2	-14.5	EN
	11	27.83	27.81	27.82	1.30	1.25	-	-9.3	-11.9	EN peak 2 (M)
	12	27.86	27.69	27.70	1.32	1.15	-	-8.6	-9.9	EN
1942	01	27.19	27.38	27.59	0.65	0.80	-	-13.0	-9.6	EN
	02	27.29	27.32	27.46	0.57	0.54	-	-3.6	-6.5	EN
	03	27.51	27.66	27.31	0.38	0.51	-	-5.8	-5.2	EN end
	04	28.34	27.99	27.14	0.70	0.46	-	-5.5	-2.9	
	05	27.76	27.76	26.93	0.07	0.11	-	5.2	3.3	
	06	27.17	27.19	26.72	-0.39	-0.28	-	8.3	5.1	
	07	26.67	26.61	26.54	-0.40	-0.51	-	-1.0	2.6	LN start
	08	25.92	26.02	26.39	-0.84	-0.78	-	4.0	3.9	LN
	09	25.58	25.62	26.26	-1.04	-1.04	-	8.7	7.5	LN
	10	25.41	25.39	26.16	-1.22	-1.22	-	8.5	5.4	LN
	11	25.15	25.27	26.10	-1.38	-1.29	-	-4.0	3.6	LN peak (M)
	12	25.35	25.31	26.10	-1.19	-1.23	-	13.8	8.3	LN

Table 7. SST monthly values of the Niño 3.4 region in degrees Celsius based on HadSST time series, ONI and SOI values, and the occurrences of EN (warm) and LN (cold) events from 1871 to the present (Continued).

Year	Mon	HadSST	2-mma	12-mma	D(m)	D(m <sup>2</sup> )	ONI	SOI*	SOI(2)	Comments**
1943	01	25.38	25.42	26.14	-1.16	-1.16	-	9.4	10.8	LN
	02	25.58	25.68	26.20	-1.14	-1.10	-	10.5	8.6	LN
	03	26.16	26.27	26.28	-0.97	-0.89	-	4.0	8.0	LN
	04	27.17	27.00	26.36	-0.47	-0.52	-	13.5	8.5	LN end
	05	27.51	27.44	26.44	-0.18	-0.20	-	2.8	2.8	
	06	27.58	27.45	26.51	0.02	-0.02	-	-7.9	-2.5	
	07	27.13	27.19	26.58	0.06	0.08	-	2.9	1.4	
	08	26.93	26.88	26.67	0.17	0.08	-	7.8	6.1	
	09	26.52	26.57	26.76	-0.10	-0.09	-	5.7	7.1	
	10	26.29	26.32	26.83	-0.34	-0.29	-	9.1	7.0	
	11	26.16	26.20	26.88	-0.37	-0.36	-	3.9	2.1	
	12	26.17	26.16	26.90	-0.37	-0.38	-	-8.6	-5.4	
1944	01	26.15	26.35	26.92	-0.39	-0.24	-	-8.2	-5.3	
	02	26.92	26.76	26.92	0.20	-0.02	-	3.9	1.3	
	03	27.05	27.23	26.92	-0.08	0.07	-	5.6	2.4	
	04	27.88	27.70	26.92	0.24	0.18	-	-5.5	-1.6	
	05	28.00	27.90	26.94	0.31	0.26	-	-1.1	-2.9	
	06	27.72	27.69	26.95	0.16	0.22	-	-3.9	-4.5	
	07	27.30	27.30	26.96	0.23	0.19	-	-8.9	-4.6	
	08	26.88	26.88	26.94	0.12	0.07	-	3.3	0.1	
	09	26.44	26.57	26.89	-0.18	-0.09	-	2.6	0.0	
	10	26.51	26.44	26.83	-0.12	-0.16	-	-8.6	-5.3	
	11	26.31	26.37	26.77	-0.22	-0.19	-	-6.7	-4.5	
	12	26.33	26.30	26.71	-0.21	-0.24	-	4.2	1.7	
1945	01	26.22	26.27	26.66	-0.32	-0.32	-	5.1	5.2	
	02	26.29	26.32	26.60	-0.43	-0.46	-	6.3	7.7	
	03	26.47	26.56	26.54	-0.66	-0.60	-	13.2	6.4	
	04	27.01	26.98	26.49	-0.63	-0.55	-	-7.1	-0.3	
	05	27.41	27.23	26.46	-0.28	-0.42	-	-0.3	0.2	
	06	27.09	27.05	26.45	-0.47	-0.42	-	8.3	5.0	
	07	26.62	26.59	26.43	-0.45	-0.53	-	3.5	6.8	
	08	26.03	26.15	26.44	-0.73	-0.65	-	11.7	8.9	
	09	25.93	25.94	26.47	-0.69	-0.72	-	8.7	7.9	
	10	25.87	25.96	26.50	-0.76	-0.63	-	2.4	2.5	
	11	26.23	26.10	26.51	-0.30	-0.46	-	-3.4	0.6	
	12	26.05	26.12	26.54	-0.49	-0.42	-	6.7	1.9	
1946	01	26.14	26.22	26.60	-0.40	-0.37	-	-2.5	1.5	
	02	26.53	26.53	26.64	-0.19	-0.25	-	4.4	1.1	
	03	26.90	26.91	26.68	-0.23	-0.25	-	-2.0	-2.3	
	04	27.29	27.24	26.74	-0.35	-0.29	-	-9.6	-8.2	
	05	27.47	27.52	26.79	-0.22	-0.13	-	-11.4	-10.5	
	06	27.83	27.60	26.82	0.27	0.13	-	-9.6	-10.2	
	07	27.26	27.18	26.88	0.19	0.06	-	-10.2	-8.6	
	08	26.36	26.64	26.92	-0.40	-0.17	-	-4.4	-8.8	
	09	26.56	26.55	26.95	-0.06	-0.11	-	-16.0	-12.2	
	10	26.73	26.37	26.99	0.10	0.02	-	-12.3	-10.5	
	11	26.47	26.57	27.00	-0.06	0.01	-	-1.4	-5.2	
	12	26.61	26.69	27.00	0.07	0.13	-	-5.5	-4.3	

Table 7. SST monthly values of the Niño 3.4 region in degrees Celsius based on HadSST time series, ONI and SOI values, and the occurrences of EN (warm) and LN (cold) events from 1871 to the present (Continued).

Year	Mon	HadSST	2-mma	12-mma	D(m)	D(m <sup>2</sup> )	ONI	SOI*	SOI(2)	Comments**
1947	01	26.97	26.80	26.97	0.43	0.21	–	–4.9	–4.9	
	02	26.63	26.94	26.96	–0.09	0.17	–	–4.1	–0.4	
	03	27.54	27.35	26.93	0.41	0.20	–	11.6	3.6	
	04	27.70	27.57	26.86	0.06	0.04	–	–4.6	–2.8	
	05	27.32	27.52	26.81	–0.37	–0.12	–	–13.7	–7.4	
	06	27.75	27.41	26.79	0.19	–0.06	–	2.6	0.2	
	07	26.83	26.98	26.78	–0.24	–0.14	–	9.4	7.2	
	08	26.51	26.39	26.79	–0.25	–0.42	–	7.2	8.9	
	09	25.70	25.96	26.83	–0.92	–0.70	–	11.7	7.2	
	10	25.92	25.87	26.85	–0.71	–0.74	–	–1.9	4.3	
	11	25.93	26.14	26.90	–0.60	–0.42	–	9.2	5.4	
	12	26.77	26.53	26.94	0.23	–0.01	–	5.2	4.2	
1948	01	26.63	26.79	26.95	0.09	0.21	–	–3.0	0.5	
	02	27.13	27.20	26.98	0.41	0.42	–	–2.7	–3.1	
	03	27.89	27.73	27.08	0.76	0.58	–	–4.1	–2.0	
	04	28.02	28.03	27.09	0.38	0.50	–	2.8	1.3	
	05	28.17	28.03	27.11	0.48	0.38	–	3.6	1.3	
	06	27.75	27.71	27.13	0.19	0.24	–	–4.7	–1.2	
	07	27.16	27.23	27.12	0.09	0.12	–	0.9	–1.8	
	08	26.85	26.90	27.09	0.09	0.10	–	–4.4	–3.9	
	09	26.73	26.59	27.04	0.11	–0.07	–	–7.6	–3.4	
	10	26.06	26.30	26.99	–0.57	–0.30	–	6.1	2.3	
	11	26.35	26.43	26.97	–0.18	–0.13	–	4.6	2.5	
	12	26.96	26.60	26.92	0.42	0.06	–	–5.5	–3.4	
1949	01	26.12	26.56	26.88	–0.42	–0.03	–	–7.3	–4.5	
	02	27.02	26.72	26.85	0.30	–0.06	–	2.0	0.6	
	03	26.70	27.10	26.81	–0.43	–0.06	–	5.6	3.6	
	04	27.96	27.60	26.78	0.32	0.08	–	1.2	0.6	
	05	27.79	27.63	26.74	0.10	–0.02	–	–5.8	–5.6	
	06	26.97	27.14	26.63	–0.59	–0.33	–	–12.0	–7.9	
	07	26.84	26.80	26.54	–0.23	–0.31	–	–1.7	–5.0	
	08	26.56	26.52	26.44	–0.20	–0.29	–	–4.4	–2.1	
	09	26.10	26.19	26.35	–0.52	–0.47	–	2.0	1.3	
	10	26.01	25.86	26.28	–0.62	–0.74	–	5.4	1.7	LN start
	11	25.33	25.52	26.18	–1.20	–1.04	–	–6.0	0.3	LN
	12	25.39	25.41	26.13	–1.15	–1.13	–	7.7	3.6	LN
1950	01	25.53	25.43	26.09	–1.01	–1.16	–1.7b	5.1	8.9	LN
	02	25.26	25.56	26.05	–1.46	–1.22	–1.5	17.6	14.5	LN peak 1 (M)
	03	26.18	26.12	26.02	–0.95	–1.04	–1.3	17.6	17.4	LN
	04	26.86	26.62	25.99	–0.78	–0.91	–1.4p2	16.8	14.7	LN
	05	26.56	26.70	25.99	–1.13	–0.95	–1.3	7.6	14.7	LN peak 2 (W)
	06	26.82	26.59	25.99	–0.74	–0.89	–1.1	26.9	20.6	LN
	07	26.14	26.34	25.99	–0.93	–0.78	–0.8	21.1	20.4	LN
	08	26.24	26.07	26.02	–0.52	–0.74	–0.8	12.3	13.2	LN
	09	25.65	25.86	26.07	–0.97	–0.80	–0.8	6.9	10.8	LN
	10	25.90	25.68	26.11	–0.73	–0.92	–0.9	17.1	13.4	LN
	11	25.27	25.50	26.19	–1.26	–1.06	–0.9	12.5	16.3	LN
	12	25.55	25.46	26.27	–0.99	–1.08	–1.0p3	23.0	18.8	LN peak 3 (M)

Table 7. SST monthly values of the Niño 3.4 region in degrees Celsius based on HadSST time series, ONI and SOI values, and the occurrences of EN (warm) and LN (cold) events from 1871 to the present (Continued).

Year	Mon	HadSST	2-mma	12-mma	D(m)	D(m <sup>2</sup> )	ONI	SOI*	SOI(2)	Comments**
1951	01	25.45	25.62	26.38	-1.09	-0.97	-1.0p3	16.5	16.4	LN
	02	26.02	25.99	26.51	-0.70	-0.79	-0.9	9.6	8.6	LN
	03	26.48	26.65	26.65	-0.65	-0.51	-0.6e	-1.4	1.4	LN end
	04	27.60	27.36	26.79	-0.04	-0.16	-0.3	-1.3	-2.7	
	05	27.77	27.69	26.95	0.08	0.04	-0.2	-6.6	-2.4	
	06	27.60	27.71	27.11	0.04	0.24	0.2	5.0	-1.2	
	07	27.88	27.78	27.25	0.81	0.67	0.4	-8.2	-3.0	EN start
	08	27.77	27.71	27.36	1.01	0.91	0.7s	-0.5	-4.1	EN peak (W)
	09	27.42	27.53	27.43	0.80	0.88	0.7	-7.0	-5.6	EN
	10	27.52	27.48	27.49	0.89	0.87	0.8p	-8.0	-6.6	EN
	11	27.44	27.43	27.50	0.91	0.87	0.7	-3.4	-4.5	EN
	12	27.30	27.25	27.46	0.76	0.72	0.6e	-3.0	-4.7	EN end
1952	01	26.97	27.06	27.39	0.43	0.42	0.3	-9.2	-7.3	
	02	27.00	27.07	27.28	0.28	0.29	0.1	-7.9	-6.2	
	03	27.30	27.45	27.18	0.17	0.29	0.1	0.2	-4.1	
	04	28.18	27.79	27.11	0.54	0.26	0.2	-8.8	-2.9	
	05	27.48	27.54	27.03	-0.21	-0.10	0.1	6.0	2.7	
	06	27.03	27.04	26.93	-0.53	-0.43	-0.1	7.4	6.1	
	07	26.63	26.69	26.87	-0.44	-0.43	-0.3	3.5	2.7	
	08	26.45	26.48	26.87	-0.31	-0.32	-0.3	-3.7	-1.8	
	09	26.40	26.49	26.88	-0.22	-0.17	-0.2	-3.4	-2.2	
	10	26.70	26.53	26.90	0.07	-0.07	-0.2	1.8	-0.1	
	11	26.33	26.35	26.95	-0.20	-0.16	-0.1	-0.7	-3.1	
	12	26.04	26.35	27.02	-0.50	-0.20	0.0	-12.6	-5.9	
1953	01	26.94	26.73	27.10	0.40	0.15	0.2	2.2	-3.6	
	02	27.00	27.11	27.15	0.28	0.33	0.4	-6.0	-3.9	
	03	27.48	27.63	27.22	0.35	0.47	0.5	-5.8	-4.5	
	04	28.54	28.19	27.26	0.90	0.67	0.5	-0.5	-9.7	
	05	28.21	28.27	27.30	0.52	0.62	0.5	-31.9	-16.7	
	06	28.10	27.96	27.35	0.54	0.49	0.5	-2.3	-9.4	
	07	27.42	27.46	27.38	0.35	0.35	0.4	-1.0	-5.4	
	08	26.91	27.17	27.38	0.15	0.36	0.4	-17.2	-12.1	
	09	27.42	27.15	27.37	0.80	0.49	0.4	-13.0	-10.8	
	10	26.84	27.02	27.32	0.21	0.41	0.4	-0.1	-3.8	
	11	26.96	26.88	27.24	0.43	0.32	0.4	-2.0	-2.0	
	12	26.74	26.85	27.15	0.20	0.32	0.4	-4.0	-1.0	
1954	01	26.97	26.89	27.05	0.43	0.33	0.5	6.0	1.1	
	02	26.98	27.05	26.95	0.26	0.27	0.3	-3.6	-0.5	
	03	27.27	27.24	26.85	0.14	0.09	-0.1	-0.9	0.4	
	04	27.45	27.38	26.72	-0.19	-0.15	-0.5s	6.9	4.3	
	05	27.34	27.25	26.62	-0.35	-0.39	-0.7	4.4	3.6	
	06	26.88	26.83	26.52	-0.68	-0.65	-0.7	-1.5	1.4	LN start
	07	26.20	26.27	26.43	-0.87	-0.85	-0.8	4.2	4.3	LN
	08	25.80	25.88	26.35	-0.96	-0.92	-1.0	10.4	7.4	LN peak 1 (W)
	09	25.72	25.77	26.27	-0.90	-0.89	-1.2p1	4.5	5.3	LN
	10	25.82	25.71	26.21	-0.81	-0.89	-1.1	1.8	3.0	LN
	11	25.49	25.65	26.16	-1.04	-0.91	-1.1	3.9	5.6	LN peak 2 (W)
	12	25.79	25.75	26.11	-0.75	-0.79	-1.1	12.8	6.0	LN

Table 7. SST monthly values of the Niño 3.4 region in degrees Celsius based on HadSST time series, ONI and SOI values, and the occurrences of EN (warm) and LN (cold) events from 1871 to the present (Continued).

Year	Mon	HadSST	2-mma	12-mma	D(m)	D(m <sup>2</sup> )	ONI	SOI*	SOI(2)	Comments**
1955	01	25.92	25.90	26.08	-0.62	-0.68	-1.0	-5.4	4.3	LN
	02	25.98	26.09	26.08	-0.72	-0.68	-0.9	15.2	7.0	LN
	03	26.46	26.42	26.07	-0.67	-0.72	-0.9	2.9	4.5	LN
	04	26.82	26.69	26.03	-0.82	-0.84	-1.0	-3.0	2.5	LN
	05	26.64	26.65	25.97	-1.05	-1.00	-1.0	13.1	9.9	LN
	06	26.49	26.38	25.91	-1.07	-1.09	-1.0	16.4	16.3	LN peak 3 (M)
	07	25.91	26.07	25.86	-1.16	-1.05	-1.0	19.2	17.4	LN
	08	25.96	25.81	25.82	-0.80	-0.99	-1.0	14.9	15.8	LN
	09	25.42	25.49	25.81	-1.20	-1.17	-1.4	14.1	14.6	LN
	10	25.14	25.11	25.81	-1.49	-1.49	-1.8	15.2	14.9	LN
	11	24.75	24.93	25.85	-1.78	-1.56	-2.0p2	15.1	13.7	LN peak 4 (S)
	12	25.07	25.06	25.89	-1.47	-1.48	-1.9	9.3	11.3	LN
1956	01	25.35	25.39	25.92	-1.19	-1.20	-1.3	11.3	11.1	LN
	02	25.79	25.81	25.94	-0.93	-0.97	-0.9	12.4	11.4	LN
	03	26.32	26.36	25.96	-0.81	-0.80	-0.7	9.4	10.6	LN
	04	26.99	26.90	26.01	-0.65	-0.63	-0.6	11.1	12.4	LN
	05	27.28	27.10	26.09	-0.41	-0.55	-0.6	17.9	14.8	LN
	06	26.85	26.82	26.17	-0.71	-0.66	-0.6	12.3	13.8	LN
	07	26.28	26.37	26.23	-0.79	-0.75	-0.7	12.6	12.1	LN peak 5 (W)
	08	26.06	26.06	26.29	-0.70	-0.74	-0.8	11.0	8.7	LN
	09	25.84	25.95	26.36	-0.78	-0.71	-0.8	0.2	7.4	LN
	10	26.04	25.89	26.46	-0.59	-0.71	-0.9p3	18.3	9.7	LN
	11	25.64	25.83	26.55	-0.89	-0.73	-0.9p3	1.9	8.1	LN peak 6(W)
	12	26.01	25.92	26.65	-0.53	-0.62	-0.8p3	10.3	7.0	LN end
1957	01	26.02	26.14	26.77	-0.52	-0.44	-0.5e	5.6	4.8	
	02	26.52	26.60	26.91	-0.20	-0.18	-0.1	-2.2	0.1	
	03	27.34	27.35	27.04	-0.21	-0.02	0.3	-0.9	-0.7	
	04	28.19	28.01	27.16	0.55	0.38	0.6s	1.2	-2.7	
	05	28.31	28.26	27.30	0.62	0.61	0.7	-12.2	-6.4	EN start
	06	28.22	28.17	27.46	0.66	0.70	0.9p1	-2.3	-4.0	EN
	07	27.91	27.93	27.62	0.84	0.81	0.9p1	0.9	-2.5	EN
	08	27.66	27.63	27.78	0.90	0.83	0.9p1	-9.5	-7.2	EN peak 1 (W)
	09	27.28	27.43	27.89	0.66	0.77	0.9p1	-10.6	-8.0	EN
	10	27.48	27.50	27.92	0.85	0.89	1.0	-1.3	-6.3	EN
	11	27.74	27.68	27.91	1.21	1.12	1.2	-11.9	-7.2	EN
	12	27.76	27.85	27.89	1.22	1.31	1.5	-3.5	-8.9	EN
1958	01	28.12	28.04	27.86	1.58	1.46	1.7p2	-16.8	-11.0	EN peak 2 (M)
	02	28.16	28.17	27.81	1.44	1.40	1.5	-6.9	-8.0	EN
	03	28.25	28.19	27.75	1.12	1.03	1.2	-1.4	-2.1	EN
	04	28.08	28.15	27.68	0.44	0.63	0.8	1.2	-1.8	EN end
	05	28.19	28.11	27.61	0.50	0.47	0.6	-8.2	-3.8	
	06	27.99	27.86	27.53	0.43	0.39	0.5e	0.2	-1.4	
	07	27.26	27.41	27.45	0.19	0.29	0.3	2.2	3.1	
	08	27.12	26.99	27.36	0.36	0.18	0.1	7.8	3.6	
	09	26.44	26.68	27.29	-0.18	0.02	0.0	-3.4	-0.2	
	10	26.70	26.64	27.26	0.07	0.04	0.0	-1.9	-3.0	
	11	26.71	26.75	27.25	0.18	0.20	0.2	-4.7	-4.5	
	12	26.89	26.88	27.21	0.35	0.34	0.4	-6.5	-6.6	

Table 7. SST monthly values of the Niño 3.4 region in degrees Celsius based on HadSST time series, ONI and SOI values, and the occurrences of EN (warm) and LN (cold) events from 1871 to the present (Continued).

Year	Mon	HadSST	2-mma	12-mma	D(m)	D(m <sup>2</sup> )	ONI	SOI*	SOI(2)	Comments**
1959	01	27.01	27.04	27.17	0.47	0.46	0.4	-8.7	-9.5	
	02	27.26	27.26	27.13	0.54	0.49	0.5	-14.0	-7.1	
	03	27.52	27.59	27.09	0.39	0.43	0.4	8.4	1.6	
	04	28.04	27.86	27.09	0.40	0.34	0.2	3.6	4.6	
	05	27.85	27.78	27.08	0.16	0.13	0.0	2.8	0.7	
	06	27.36	27.38	27.06	-0.20	-0.09	-0.2	-6.3	-3.7	
	07	26.95	26.93	27.03	-0.12	-0.18	-0.4	-5.0	-5.3	
	08	26.47	26.53	26.98	-0.29	-0.28	-0.5	-5.0	-3.7	
	09	26.22	26.44	26.93	-0.40	-0.22	-0.4	0.2	-0.1	
	10	26.84	26.60	26.91	0.21	-0.01	-0.3	4.2	4.9	
	11	26.48	26.59	26.90	-0.05	0.03	-0.2	11.1	8.7	
	12	26.54	26.54	26.91	0.00	0.00	-0.2	8.2	7.0	
1960	01	26.60	26.57	26.92	0.06	-0.02	-0.3	0.3	1.7	
	02	26.52	26.70	26.93	-0.20	-0.08	-0.3	-2.2	0.4	
	03	27.17	27.16	26.97	0.04	0.01	-0.3	5.6	4.2	
	04	27.78	27.66	26.99	0.14	0.14	-0.2	7.8	6.6	
	05	27.92	27.78	26.97	0.23	0.13	-0.2	5.2	4.0	
	06	27.48	27.47	26.97	-0.08	-0.01	-0.2	-2.3	1.4	
	07	26.98	27.08	26.96	-0.09	-0.04	-0.1	4.8	3.5	
	08	26.87	26.88	26.97	0.11	0.08	0.0	6.6	6.2	
	09	26.79	26.78	26.98	0.17	0.12	-0.1	6.9	4.9	
	10	26.67	26.60	26.98	0.04	0.00	-0.2	-0.7	3.2	
	11	26.27	26.45	26.99	-0.26	-0.11	-0.2	7.2	5.1	
	12	26.60	26.48	27.00	0.06	-0.06	-0.2	6.7	4.5	
1961	01	26.43	26.57	27.01	-0.11	-0.02	-0.2	-2.5	2.0	
	02	26.80	26.80	26.99	0.08	0.02	-0.2	6.3	-2.7	
	03	27.16	27.26	26.96	0.03	0.10	-0.2	-20.9	-6.5	
	04	27.90	27.71	26.91	0.26	0.18	-0.1	9.4	-0.2	
	05	27.86	27.85	26.89	0.17	0.21	0.1	1.3	2.2	
	06	27.79	27.59	26.89	0.23	0.12	0.2	-3.1	-0.7	
	07	26.90	27.05	26.87	-0.17	-0.06	0.0	2.2	0.4	
	08	26.62	26.59	26.86	-0.14	-0.21	-0.3	0.1	0.8	
	09	26.23	26.28	26.83	-0.39	-0.38	-0.6	0.8	-0.8	
	10	26.02	26.18	26.80	-0.61	-0.42	-0.6	-5.0	-0.5	
	11	26.46	26.31	26.77	-0.07	-0.25	-0.5	7.2	5.8	
	12	26.30	26.35	26.74	-0.24	-0.19	-0.4	13.8	13.0	
1962	01	26.33	26.39	26.72	-0.21	-0.20	-0.4	17.0	13.3	
	02	26.60	26.60	26.73	-0.12	-0.18	-0.4	5.3	6.6	
	03	26.85	26.94	26.73	-0.28	-0.22	-0.4	-1.4	0.9	
	04	27.45	27.30	26.75	-0.19	-0.23	-0.5	1.2	3.3	
	05	27.45	27.46	26.75	-0.24	-0.19	-0.4	12.3	7.7	
	06	27.47	27.33	26.74	-0.09	-0.14	-0.4	5.0	5.5	
	07	26.92	27.01	26.72	-0.15	-0.10	-0.3	-0.4	2.2	
	08	26.74	26.65	26.72	-0.02	-0.16	-0.3	4.6	3.5	
	09	26.19	26.38	26.73	-0.43	-0.28	-0.5	5.1	6.3	
	10	26.41	26.31	26.75	-0.22	-0.30	-0.6	10.3	7.7	
	11	26.22	26.24	26.78	-0.31	-0.32	-0.7	5.2	5.3	
	12	26.09	26.17	26.81	-0.45	-0.37	-0.7	0.6	4.0	

Table 7. SST monthly values of the Niño 3.4 region in degrees Celsius based on HadSST time series, ONI and SOI values, and the occurrences of EN (warm) and LN (cold) events from 1871 to the present (Continued).

Year	Mon	HadSST	2-mma	12-mma	D(m)	D(m <sup>2</sup> )	ONI	SOI*	SOI(2)	Comments**
1963	01	26.26	26.28	26.87	-0.28	-0.31	-0.6	9.4	5.6	
	02	26.50	26.62	26.96	-0.22	-0.16	-0.3	3.0	5.7	
	03	27.20	27.15	27.05	0.07	0.00	0.0	7.3	5.9	
	04	27.71	27.62	27.15	0.07	0.10	0.1	6.1	5.6	
	05	27.86	27.81	27.25	0.17	0.17	0.1	2.8	0.5	
	06	27.81	27.86	27.36	0.25	0.39	0.3	-9.6	-4.4	
	07	27.95	27.87	27.47	0.88	0.76	0.6s	-1.0	-3.5	EN start
	08	27.78	27.73	27.55	1.02	0.93	0.8	-2.4	-2.8	EN peak 1 (W)
	09	27.40	27.54	27.58	0.78	0.88	0.9	-5.2	-6.4	EN
	10	27.57	27.49	27.55	0.94	0.88	0.9	-12.9	-10.1	EN
	11	27.40	27.50	27.50	0.87	0.94	1.0p	-9.3	-10.8	EN
	12	27.63	27.50	27.43	1.09	0.96	1.0p	-11.6	-9.1	EN peak 2 (W)
1964	01	27.33	27.40	27.33	0.79	0.82	0.8e	-4.0	-5.0	EN end
	02	27.31	27.26	27.20	0.59	0.49	0.4	-0.3	1.0	
	03	27.10	27.19	27.07	-0.03	0.03	-0.1	8.4	7.5	
	04	27.24	27.18	26.93	-0.40	-0.35	-0.5s	13.5	9.6	
	05	27.13	27.08	26.77	-0.56	-0.57	-0.8	2.8	6.6	LN start
	06	26.81	26.83	26.61	-0.75	-0.64	-0.8	7.4	6.1	LN peak 1 (W)
	07	26.58	26.52	26.46	-0.49	-0.60	-0.9	6.8	8.8	LN
	08	26.11	26.16	26.37	-0.65	-0.65	-1.0	14.3	12.4	LN
	09	25.82	25.87	26.33	-0.80	-0.79	-1.1	14.1	13.8	LN
	10	25.73	25.71	26.34	-0.90	-0.90	-1.2p	12.8	10.6	LN
	11	25.55	25.59	26.39	-0.98	-0.97	-1.2p	2.6	3.8	LN peak 2 (W)
	12	25.52	25.65	26.49	-1.02	-0.89	-1.0	-3.0	-1.9	LN
1965	01	26.01	25.99	26.60	-0.53	-0.60	-0.8e	-4.0	-2.4	LN end
	02	26.41	26.44	26.75	-0.31	-0.34	-0.4	1.6	0.5	
	03	26.92	26.98	26.92	-0.21	-0.17	-0.2	2.9	-1.4	
	04	27.68	27.58	27.12	0.04	0.06	0.0	-12.9	-5.8	
	05	28.05	27.98	27.34	0.36	0.34	0.3	-0.3	-6.6	
	06	28.14	28.09	27.56	0.58	0.62	0.6s	-12.8	-12.1	EN start
	07	28.03	28.08	27.73	0.96	0.97	1.0	-22.6	-17.4	EN
	08	28.12	28.07	27.85	1.36	1.27	1.2	-11.4	-14.9	EN
	09	28.01	28.12	27.95	1.39	1.46	1.4	-14.2	-12.7	EN
	10	28.34	28.22	28.03	1.71	1.62	1.5	-11.1	-13.6	EN
	11	28.20	28.20	28.04	1.67	1.64	1.6p	-17.9	-11.3	EN peak (S)
	12	28.04	28.00	28.02	1.50	1.46	1.5	1.6	-6.7	EN
1966	01	27.71	27.76	27.98	1.17	1.18	1.2	-12.0	-6.6	EN
	02	27.59	27.74	27.90	0.87	0.97	1.0	-4.1	-8.5	EN
	03	28.08	28.02	27.79	0.95	0.86	0.8	-13.9	-9.8	EN
	04	28.31	28.13	27.67	0.67	0.60	0.5e	-7.1	-9.3	EN end
	05	27.81	27.94	27.52	0.12	0.29	0.2	-9.0	-6.0	
	06	27.82	27.73	27.37	0.26	0.26	0.2	1.0	-2.0	
	07	27.45	27.37	27.22	0.38	0.26	0.2	-1.0	0.8	
	08	26.77	26.92	27.10	0.01	0.12	0.0	4.0	1.2	
	09	26.70	26.72	26.98	0.08	0.06	-0.2	-2.2	-2.7	
	10	26.69	26.59	26.89	0.06	0.01	-0.2	-2.5	-1.8	
	11	26.28	26.39	26.83	-0.25	-0.17	-0.3	-0.1	-1.7	
	12	26.32	26.24	26.82	-0.22	-0.30	-0.3	-4.0	1.6	

Table 7. SST monthly values of the Niño 3.4 region in degrees Celsius based on HadSST time series, ONI and SOI values, and the occurrences of EN (warm) and LN (cold) events from 1871 to the present (Continued).

Year	Mon	HadSST	2-mma	12-mma	D(m)	D(m <sup>2</sup> )	ONI	SOI*	SOI(2)	Comments**
1967	01	26.02	26.14	26.79	-0.52	-0.45	-0.4	14.6	9.5	
	02	26.20	26.30	26.77	-0.52	-0.48	-0.4	12.9	12.1	
	03	26.79	26.76	26.74	-0.34	-0.40	-0.6	7.8	6.4	
	04	27.24	27.23	26.70	-0.40	-0.30	-0.5	-3.0	1.3	
	05	27.63	27.52	26.69	-0.06	-0.13	-0.3	-3.5	-0.9	
	06	27.56	27.47	26.69	0.00	0.00	0.0	6.6	2.8	
	07	27.12	27.09	26.68	0.05	-0.02	0.0	1.6	3.9	
	08	26.57	26.61	26.67	-0.19	-0.20	-0.2	5.9	4.6	
	09	26.17	26.32	26.65	-0.45	-0.34	-0.4	5.1	4.0	
	10	26.35	26.30	26.64	-0.28	-0.31	-0.5	-0.1	0.2	
	11	26.32	26.31	26.64	-0.21	-0.25	-0.4	-4.0	-3.4	
	12	26.24	26.20	26.64	-0.30	-0.34	-0.5	-5.5	-2.7	
1968	01	25.98	26.06	26.67	-0.56	-0.53	-0.7	4.1	3.1	
	02	26.02	26.13	26.72	-0.70	-0.65	-0.9	9.6	5.1	
	03	26.50	26.58	26.77	-0.63	-0.58	-0.8	-3.0	0.2	
	04	27.30	27.13	26.83	-0.34	-0.39	-0.7	-3.0	1.4	
	05	27.43	27.51	26.90	-0.26	-0.14	-0.3	14.7	9.7	
	06	27.87	27.68	26.99	0.31	0.21	0.0	12.3	11.7	
	07	27.54	27.54	27.10	0.47	0.42	0.3	7.4	6.8	
	08	27.20	27.19	27.24	0.44	0.38	0.4	0.1	1.2	
	09	26.80	26.96	27.37	0.18	0.31	0.3	-2.8	-1.9	
	10	27.05	27.08	27.46	0.42	0.48	0.4	-1.9	-2.5	
	11	27.42	27.31	27.53	0.89	0.75	0.7s	-3.4	-1.7	EN start
	12	27.35	27.40	27.56	0.81	0.86	0.9	2.1	-3.2	EN
1969	01	27.48	27.53	27.56	0.94	0.94	1.0p	-13.5	-8.0	EN
	02	27.79	27.73	27.56	1.07	0.95	1.0p	-6.9	-6.4	EN peak (W)
	03	27.86	27.79	27.58	0.73	0.75	0.9	1.8	-3.0	EN
	04	28.10	28.08	27.61	0.96	0.55	0.7	-8.8	-5.6	EN end
	05	28.25	28.14	27.63	0.56	0.49	0.6	-6.6	-5.7	
	06	27.95	27.87	27.62	0.39	0.40	0.5e	-0.6	-3.7	
	07	27.32	27.50	27.60	0.25	0.38	0.4	-6.9	-4.7	
	08	27.39	27.33	27.56	0.63	0.53	0.4	-4.4	-6.6	EN start
	09	27.22	27.31	27.52	0.60	0.65	0.6s	-10.6	-9.3	EN
	10	27.39	27.35	27.50	0.76	0.75	0.7	-11.7	-8.5	EN
	11	27.40	27.37	27.48	0.87	0.81	0.8p	-0.1	-2.1	EN peak (W)
	12	27.27	27.27	27.44	0.73	0.73	0.7	3.7	-0.7	EN
1970	01	27.13	27.16	27.37	0.59	0.58	0.5e	-10.1	-6.8	EN end
	02	27.12	27.22	27.26	0.40	0.45	0.3	-10.7	-7.4	
	03	27.52	27.53	27.15	0.39	0.37	0.2	1.8	-2.9	
	04	27.95	27.82	27.04	0.31	0.30	0.1	-4.6	-1.3	
	05	27.87	27.77	26.92	0.18	0.12	0.0	2.1	2.4	
	06	27.38	27.22	26.78	-0.18	-0.07	-0.3	9.9	4.1	
	07	26.25	26.45	26.62	-0.82	-0.67	-0.6s	-5.6	0.7	LN start
	08	25.92	26.02	26.47	-0.84	-0.79	-0.8	4.0	3.8	LN peak 1 (W)
	09	25.97	25.99	26.34	-0.65	-0.67	-0.9p1	12.9	10.0	LN
	10	26.08	25.99	26.27	-0.55	-0.62	-0.8	10.3	13.3	LN
	11	25.81	25.79	26.14	-0.72	-0.77	-0.9	19.7	16.8	LN
	12	25.47	25.47	26.09	-1.07	-1.07	-1.1	17.4	14.3	LN



Table 7. SST monthly values of the Niño 3.4 region in degrees Celsius based on HadSST time series, ONI and SOI values, and the occurrences of EN (warm) and LN (cold) events from 1871 to the present (Continued).

Year	Mon	HadSST	2-mma	12-mma	D(m)	D(m <sup>2</sup> )	ONI	SOI*	SOI(2)	Comments**
1971	01	25.11	25.29	26.08	-1.43	-1.29	-1.3p2	2.7	9.6	LN peak 2 (M)
	02	25.48	25.51	26.11	-1.24	-1.27	-1.3p2	15.7	13.3	LN
	03	25.96	26.05	26.12	-1.17	-1.11	-1.1	19.2	19.2	LN
	04	26.80	26.65	26.12	-0.84	-0.88	-0.9	22.6	18.4	LN
	05	27.04	26.95	26.11	-0.65	-0.70	-0.8	9.2	10.9	LN
	06	26.91	26.86	26.12	-0.65	-0.61	-0.8	2.6	4.0	LN
	07	26.59	26.58	26.17	-0.48	-0.54	-0.8	1.6	5.2	LN
	08	26.22	26.26	26.25	-0.54	-0.55	-0.8	14.9	11.8	LN
	09	26.00	26.04	26.34	-0.62	-0.62	-0.8	15.9	16.1	LN
	10	25.95	25.93	26.43	-0.68	-0.68	-0.9	17.7	14.6	LN
	11	25.80	25.81	26.53	-0.73	-0.75	-1.0p3	7.2	8.6	LN peak 3 (W)
	12	25.69	25.80	26.63	-0.85	-0.74	-0.9	2.1	3.8	LN
1972	01	26.00	26.06	26.75	-0.54	-0.53	-0.7e	3.7	4.4	LN end
	02	26.55	26.53	26.90	-0.17	-0.25	-0.4	8.2	5.6	
	03	27.00	27.13	27.06	-0.13	-0.02	0.0	2.4	1.9	
	04	27.98	27.79	27.25	0.34	0.26	0.2	-5.5	-6.2	
	05	28.19	28.18	27.47	0.50	0.53	0.5s	-16.1	-12.4	EN start
	06	28.35	28.24	27.71	0.79	0.77	0.8	-12.0	-14.7	EN
	07	28.06	28.16	27.93	0.99	1.05	1.0	-18.6	-14.5	EN
	08	28.18	28.09	28.07	1.42	1.29	1.3	-8.9	-12.8	EN
	09	27.94	28.14	28.16	1.32	1.48	1.5	-14.8	-12.4	EN
	10	28.50	28.37	28.19	1.87	1.77	1.8	-11.1	-10.1	EN
	11	28.53	28.59	28.14	2.00	2.03	2.0	-3.4	-7.5	EN peak (VS)
	12	28.78	28.57	28.04	2.24	2.03	2.1p	-12.1	-7.7	EN peak (VS)
1973	01	28.18	28.25	27.89	1.64	1.66	1.8	-3.0	-7.9	EN
	02	27.84	27.92	27.70	1.12	1.15	1.2	-13.5	-7.3	EN
	03	27.83	27.80	27.49	0.70	0.65	0.5e	0.8	-3.5	EN end
	04	27.70	27.63	27.24	0.06	0.11	-0.1	-2.1	-0.2	
	05	27.30	27.28	26.94	-0.39	-0.36	-0.6s	2.8	4.0	
	06	26.83	26.76	26.59	-0.73	-0.71	-0.9	12.3	8.4	LN start
	07	26.08	26.16	26.26	-0.99	-0.95	-1.1	6.1	9.2	LN
	08	25.66	25.69	26.00	-1.10	-1.12	-1.3	12.3	11.1	LN
	09	25.35	25.38	25.81	-1.27	-1.28	-1.4	13.5	12.3	LN
	10	25.15	25.06	25.69	-1.48	-1.55	-1.7	9.7	16.1	LN
	11	24.58	24.68	25.64	-1.95	-1.88	-2.0	31.6	22.5	LN
	12	24.41	24.49	25.64	-2.13	-2.05	-2.1p1	16.9	21.6	LN peak (VS)
1974	01	24.56	24.70	25.66	-1.98	-1.89	-1.9	20.8	18.7	LN
	02	25.26	25.23	25.72	-1.46	-1.55	-1.7	16.2	18.4	LN
	03	25.82	25.92	25.80	-1.31	-1.37	-1.3	20.3	17.0	LN
	04	26.77	26.61	25.88	-0.87	-0.92	-1.1	11.1	13.3	LN
	05	27.07	26.98	25.96	-0.62	-0.67	-0.9	10.7	8.8	LN
	06	26.99	26.91	26.06	-0.57	-0.56	-0.8	2.6	7.0	LN end
	07	26.58	26.68	26.19	-0.49	-0.44	-0.6	12.0	8.3	
	08	26.56	26.53	26.30	-0.20	-0.28	-0.5	6.6	9.4	
	09	26.40	26.34	26.39	-0.22	-0.32	-0.5	12.3	9.9	
	10	25.98	26.02	26.44	-0.65	-0.59	-0.7	8.5	7.0	
	11	25.70	25.78	26.45	-0.83	-0.78	-0.9p2	-1.4	1.2	
	12	25.73	25.84	26.42	-0.81	-0.70	-0.7	-0.9	-2.0	

Table 7. SST monthly values of the Niño 3.4 region in degrees Celsius based on HadSST time series, ONI and SOI values, and the occurrences of EN (warm) and LN (cold) events from 1871 to the present (Continued).

Year	Mon	HadSST	2-mma	12-mma	D(m)	D(m <sup>2</sup> )	ONI	SOI*	SOI(2)	Comments**
1975	01	26.21	26.15	26.37	-0.33	-0.44	-0.6	-4.9	-1.4	
	02	26.43	26.43	26.31	-0.29	-0.35	-0.6	5.3	4.3	
	03	26.66	26.73	26.23	-0.47	-0.42	-0.7	11.6	10.7	
	04	27.18	26.97	26.15	-0.46	-0.55	-0.8	14.4	11.6	LN start
	05	26.87	26.84	26.10	-0.82	-0.81	-0.9	6.0	10.5	LN
	06	26.43	26.43	26.05	-1.13	-1.04	-1.1	15.5	14.5	LN
	07	25.99	26.06	25.96	-1.08	-1.08	-1.2	21.1	19.6	LN
	08	25.72	25.69	25.87	-1.04	-1.12	-1.3	20.7	21.3	LN
	09	25.31	25.40	25.83	-1.31	-1.26	-1.5	22.5	20.9	LN
	10	25.26	25.26	25.84	-1.37	-1.35	-1.6	17.7	17.9	LN
	11	25.19	25.15	25.87	-1.34	-1.41	-1.7p3	13.8	16.2	LN
	12	24.95	24.97	25.94	-1.59	-1.57	-1.7p3	19.5	16.2	LN peak (S)
1976	01	24.78	25.06	26.05	-1.76	-1.53	-1.6	11.8	14.0	LN
	02	25.71	25.70	26.17	-1.01	-1.08	-1.2	12.9	12.7	LN
	03	26.58	26.56	26.31	-0.55	-0.60	-0.8	13.2	10.1	LN end
	04	27.35	27.16	26.49	-0.29	-0.36	-0.6	1.2	4.4	
	05	27.37	27.45	26.69	-0.32	-0.20	-0.5e	2.1	1.4	
	06	27.69	27.53	26.88	0.13	0.06	-0.2	0.2	-2.6	
	07	27.38	27.41	27.09	0.31	0.29	0.1	-12.8	-9.4	
	08	27.18	27.27	27.26	0.42	0.46	0.3	-12.1	-12.5	
	09	27.32	27.35	27.37	0.70	0.70	0.5s	-13.0	-8.8	EN start
	10	27.59	27.51	27.43	0.96	0.91	0.7	3.0	0.7	EN
	11	27.54	27.48	27.45	1.01	0.92	0.8p	9.8	4.9	EN peak (W)
	12	27.23	27.36	27.49	0.69	0.82	0.7	-3.0	-0.1	EN
1977	01	27.42	27.35	27.51	0.88	0.76	0.6	-4.0	-0.8	EN
	02	27.31	27.42	27.52	0.59	0.65	0.5e	7.7	0.5	EN end
	03	27.65	27.53	27.52	0.52	0.38	0.2	-9.5	-5.2	
	04	27.52	27.63	27.51	-0.12	0.11	0.2	-9.6	-10.0	
	05	27.84	27.81	27.52	0.15	0.17	0.2	-11.4	-12.5	
	06	28.05	27.90	27.55	0.49	0.43	0.4	-17.7	-15.4	
	07	27.67	27.63	27.56	0.60	0.52	0.4	-14.7	-14.8	
	08	27.13	27.15	27.55	0.37	0.48	0.4	-12.1	-12.1	
	09	27.19	27.28	27.54	0.57	0.63	0.5s	-9.4	-11.0	EN start
	10	27.62	27.53	27.52	0.99	0.93	0.6	-12.9	-12.5	EN
	11	27.69	27.67	27.49	1.16	1.11	0.7p	-14.6	-13.2	EN peak (M)
	12	27.67	27.58	27.44	1.13	1.05	0.7p	-10.6	-9.7	EN
1978	01	27.30	27.39	27.37	0.76	0.80	0.7pe	-3.0	-10.3	EN
	02	27.27	27.29	27.29	0.55	0.51	0.4	-24.4	-14.4	EN end
	03	27.32	27.33	27.21	0.19	0.17	0.0	-5.8	-11.0	
	04	27.40	27.37	27.12	-0.24	-0.15	-0.3	-7.9	-1.3	
	05	27.37	27.34	27.02	-0.32	-0.30	-0.4	16.3	7.6	
	06	27.23	27.15	26.93	-0.33	-0.33	-0.4	5.8	8.5	
	07	26.75	26.75	26.86	-0.32	-0.37	-0.4	6.1	4.9	
	08	26.26	26.36	26.81	-0.50	-0.45	-0.4	1.4	2.4	
	09	26.15	26.24	26.80	-0.47	-0.42	-0.4	0.8	-0.8	
	10	26.39	26.36	26.82	-0.24	-0.25	-0.3	-6.2	-3.4	
	11	26.50	26.51	26.86	-0.03	-0.05	-0.2	-2.0	-2.8	
	12	26.66	26.61	26.90	0.12	0.08	-0.1	-0.9	-2.0	

Table 7. SST monthly values of the Niño 3.4 region in degrees Celsius based on HadSST time series, ONI and SOI values, and the occurrences of EN (warm) and LN (cold) events from 1871 to the present (Continued).

Year	Mon	HadSST	2-mma	12-mma	D(m)	D(m <sup>2</sup> )	ONI	SOI*	SOI(2)	Comments**
1979	01	26.63	26.70	26.93	0.09	0.11	-0.1	-4.0	-0.6	
	02	26.86	26.93	26.97	0.14	0.16	0.0	6.7	1.6	
	03	27.38	27.39	27.05	0.25	0.24	0.1	-3.0	-1.2	
	04	27.94	27.76	27.13	0.30	0.23	0.1	-5.5	-2.6	
	05	27.77	27.80	27.18	0.08	0.16	0.1	3.6	1.9	
	06	27.72	27.56	27.22	0.16	0.09	-0.1	5.8	1.8	
	07	27.02	27.21	27.27	-0.05	0.10	0.0	-8.2	-3.9	
	08	27.09	27.11	27.30	0.33	0.31	0.1	-5.0	-4.2	
	09	27.23	27.15	27.31	0.61	0.49	0.3	1.4	-1.2	
	10	27.05	27.08	27.31	0.42	0.48	0.4	-2.5	-2.1	
	11	27.00	27.08	27.32	0.47	0.53	0.5	-4.7	-4.9	
	12	27.28	27.17	27.34	0.74	0.64	0.5	-7.5	-4.1	
1980	01	27.13	27.16	27.41	0.59	0.57	0.5	3.2	0.0	
	02	27.09	27.17	27.36	0.37	0.39	0.3	1.1	-0.8	
	03	27.35	27.44	27.31	0.22	0.29	0.2	-8.5	-7.2	
	04	27.97	27.82	27.27	0.33	0.30	0.2	-12.9	-9.5	
	05	28.00	28.01	27.24	0.31	0.36	0.3	-3.5	-6.2	
	06	28.05	27.84	27.22	0.49	0.37	0.3	-4.7	-3.7	
	07	27.25	27.30	27.16	0.18	0.19	0.2	-1.7	-1.7	
	08	26.65	26.80	27.09	-0.11	-0.01	0.0	1.4	-1.0	
	09	26.63	26.64	27.05	0.01	-0.02	-0.1	-5.2	-2.7	
	10	26.63	26.66	27.03	0.00	0.06	-0.1	-1.9	-3.1	
	11	26.75	26.77	27.00	0.22	0.21	0.0	-3.4	-2.4	
	12	26.94	26.69	26.97	0.40	0.15	-0.1	-0.9	-0.6	
1981	01	26.12	26.37	26.93	-0.42	-0.21	-0.3	2.7	0.3	
	02	26.31	26.50	26.92	-0.41	-0.28	-0.5	-3.2	-5.1	
	03	27.24	27.10	26.92	0.11	-0.06	-0.5	-16.6	-10.5	
	04	27.60	27.55	26.92	-0.04	0.03	-0.4	-5.5	-5.0	
	05	27.76	27.67	26.91	0.07	0.02	-0.3	7.6	5.3	
	06	27.54	27.41	26.89	-0.02	-0.06	-0.3	11.5	10.0	
	07	26.79	26.96	26.89	-0.28	-0.16	-0.4	9.4	9.1	
	08	26.70	26.72	26.92	-0.06	-0.09	-0.4	5.9	7.2	
	09	26.68	26.69	26.94	0.06	0.03	-0.3	7.5	4.0	
	10	26.70	26.62	26.95	0.07	0.02	-0.2	-5.0	0.0	
	11	26.39	26.53	27.00	-0.14	-0.03	-0.1	2.6	1.2	
	12	26.65	26.56	27.08	0.11	0.02	-0.1	4.7	5.4	
1982	01	26.54	26.59	27.17	0.00	0.01	0.0	9.4	6.0	
	02	26.64	26.77	27.26	-0.08	-0.01	0.1	0.6	3.3	
	03	27.24	27.28	27.36	0.11	0.13	0.1	2.4	0.4	
	04	28.01	27.94	27.51	0.37	0.42	0.3	-3.8	-3.4	
	05	28.51	28.41	27.69	0.82	0.77	0.6s	-8.2	-10.1	EN start
	06	28.61	28.40	27.88	1.05	0.93	0.7	-20.1	-16.9	EN peak 1 (W)
	07	27.86	28.03	28.08	0.79	0.92	0.7	-19.3	-20.6	EN
	08	27.80	27.90	28.28	1.04	1.10	1.0	-23.6	-22.0	EN
	09	28.14	28.20	28.45	1.52	1.55	1.5	-21.4	-21.7	EN
	10	28.73	28.58	28.56	2.10	1.98	1.9	-20.2	-23.2	EN
	11	28.72	28.77	28.61	2.19	2.22	2.2	-31.1	-25.9	EN
	12	28.92	28.89	28.62	2.38	2.36	2.3p	-21.3	-26.1	EN

Table 7. SST monthly values of the Niño 3.4 region in degrees Celsius based on HadSST time series, ONI and SOI values, and the occurrences of EN (warm) and LN (cold) events from 1871 to the present (Continued).

Year	Mon	HadSST	2-mma	12-mma	D(m)	D(m <sup>2</sup> )	ONI	SOI*	SOI(2)	Comments**
1983	01	29.01	28.98	28.58	2.47	2.40	2.3p	-30.6	-29.0	EN peak 2 (VS)
	02	28.98	28.98	28.50	2.26	2.20	2.0	-33.3	-31.3	EN
	03	28.95	28.94	28.38	1.82	1.79	1.5	-28.0	-26.6	EN
	04	28.89	28.93	28.18	1.25	1.41	1.2	-17.0	-14.0	EN
	05	28.99	28.80	27.92	1.30	1.15	1.0	6.0	-2.0	EN
	06	28.31	28.18	27.65	0.75	0.71	0.6e	-3.1	-2.0	EN end
	07	27.11	27.32	27.37	0.04	0.21	0.2	-7.6	-4.6	
	08	26.75	26.72	27.15	-0.01	-0.09	-0.2	0.1	0.6	
	09	26.26	26.24	26.92	-0.36	-0.42	-0.6	9.9	6.0	
	10	25.70	25.80	26.76	-0.93	-0.81	-0.8	4.2	4.4	LN start
	11	25.52	25.60	26.61	-1.01	-0.96	-0.9	-0.7	0.7	LN peak (W)
	12	25.64	25.65	26.48	-0.90	-0.89	-0.7	0.1	0.2	LN
1984	01	25.78	25.86	26.40	-0.76	-0.73	-0.4	1.3	2.1	LN
	02	26.23	26.26	26.38	-0.49	-0.52	-0.2	5.8	1.8	LN end
	03	26.78	26.74	26.37	-0.35	-0.42	-0.2	-5.8	-1.0	
	04	27.17	27.09	26.39	-0.47	-0.44	-0.3	2.0	-0.5	
	05	27.22	27.10	26.39	-0.47	-0.55	-0.5	-0.3	-1.8	
	06	26.79	26.91	26.37	-0.77	-0.57	-0.4	-8.7	-3.9	
	07	26.82	26.73	26.34	-0.25	-0.39	-0.3	2.2	-0.4	
	08	26.47	26.54	26.32	-0.29	-0.26	-0.2	2.7	2.4	
	09	26.40	26.29	26.28	-0.22	-0.37	-0.3	2.0	0.4	
	10	25.90	25.92	26.25	-0.73	-0.68	-0.6s	-5.0	-1.0	LN start
	11	25.48	25.48	26.22	-1.05	-1.08	-0.9	3.9	0.4	LN
	12	25.05	25.32	26.22	-1.49	-1.22	-1.1p	-1.4	-0.6	LN peak (M)
1985	01	25.69	25.57	26.21	-0.85	-1.02	-0.9	-3.5	-0.4	LN
	02	25.85	25.92	26.20	-0.87	-0.86	-0.8	6.7	2.0	LN
	03	26.30	26.31	26.19	-0.83	-0.85	-0.7	-2.0	4.3	LN
	04	26.79	26.71	26.19	-0.85	-0.81	-0.7	14.4	7.4	LN
	05	26.97	26.92	26.23	-0.72	-0.73	-0.7	2.8	2.6	LN
	06	26.93	26.86	26.30	-0.63	-0.61	-0.6	-9.6	-4.7	LN end
	07	26.62	26.64	26.36	-0.45	-0.48	-0.5	-2.3	-1.4	
	08	26.38	26.39	26.37	-0.38	-0.41	-0.5	8.5	3.7	
	09	26.18	26.21	26.40	-0.44	-0.45	-0.5e	0.2	0.8	
	10	26.09	26.15	26.44	-0.54	-0.46	-0.4	-5.6	-3.1	
	11	26.22	26.18	26.48	-0.31	-0.38	-0.3	-1.4	-1.6	
	12	26.19	26.10	26.53	-0.35	-0.44	-0.4	2.1	2.7	
1986	01	25.79	25.97	26.59	-0.75	-0.61	-0.5	8.0	1.9	
	02	26.12	26.20	26.65	-0.60	-0.58	-0.4	-10.7	-3.2	
	03	26.75	26.75	26.73	-0.38	-0.41	-0.2	0.8	-2.0	
	04	27.36	27.22	26.84	-0.28	-0.31	-0.2	1.2	-0.9	
	05	27.39	27.44	26.97	-0.30	-0.21	-0.1	-6.6	-0.3	
	06	27.61	27.50	27.09	0.05	0.03	0.0	10.7	4.3	
	07	27.38	27.37	27.23	0.31	0.26	0.3	2.2	1.9	
	08	27.11	27.24	27.39	0.35	0.43	0.5s	-7.6	-4.6	
	09	27.34	27.36	27.53	0.72	0.70	0.7	-5.2	-3.0	EN start
	10	27.63	27.58	27.66	1.00	0.97	0.9	6.1	-1.7	EN
	11	27.70	27.65	27.77	1.17	1.09	1.1	-13.9	-8.8	EN
	12	27.56	27.65	27.89	1.02	1.11	1.2	-13.6	-11.9	EN

Table 7. SST monthly values of the Niño 3.4 region in degrees Celsius based on HadSST time series, ONI and SOI values, and the occurrences of EN (warm) and LN (cold) events from 1871 to the present (Continued).

Year	Mon	HadSST	2-mma	12-mma	D(m)	D(m <sup>2</sup> )	ONI	SOI*	SOI(2)	Comments**
1987	01	27.77	27.76	27.99	1.23	1.18	1.2	-6.3	-9.7	EN
	02	27.94	28.04	28.09	1.22	1.26	1.3p1	-12.6	-12.0	EN peak 1 (M)
	03	28.50	28.40	28.18	1.37	1.25	1.2	-16.6	-17.6	EN
	04	28.66	28.65	28.24	1.02	1.12	1.1	-24.4	-21.8	EN
	05	28.77	28.78	28.27	1.08	1.14	1.0	-21.6	-21.9	EN
	06	28.92	28.79	28.28	1.36	1.32	1.2	-20.1	-20.1	EN
	07	28.56	28.60	28.27	1.49	1.49	1.4	-18.6	-17.8	EN
	08	28.36	28.39	28.21	1.60	1.59	1.6p2	-14.0	-14.5	EN
	09	28.28	28.26	28.14	1.66	1.60	1.6p2	-11.2	-10.5	EN peak 2 (S)
	10	28.10	28.11	28.04	1.47	1.50	1.5	-5.6	-6.0	EN
	11	27.94	27.91	27.90	1.41	1.35	1.3	-1.4	-3.2	EN
	12	27.64	27.62	27.71	1.10	1.09	1.1	-4.5	-2.9	EN
1988	01	27.27	27.32	27.47	0.73	0.74	0.7	-1.1	-2.9	EN end
	02	27.11	27.26	27.23	0.39	0.48	0.5e	-5.0	-2.2	
	03	27.54	27.37	26.99	0.41	0.21	0.1	2.4	-0.4	
	04	27.28	27.23	26.73	-0.36	-0.30	-0.2	-1.3	2.5	
	05	26.82	26.79	26.44	-0.87	-0.86	-0.7s	10.0	3.7	LN start
	06	26.23	26.10	26.17	-1.33	-1.23	-1.2	-3.9	3.4	LN
	07	25.69	25.76	25.93	-1.38	-1.36	-1.3p1	11.3	8.4	LN peak 1 (M)
	08	25.43	25.39	25.75	-1.33	-1.31	-1.2	14.9	15.3	LN
	09	25.42	25.23	25.61	-1.20	-1.43	-1.3	20.1	17.4	LN
	10	24.65	24.80	25.52	-1.98	-1.80	-1.6	14.6	17.6	LN
	11	24.48	24.55	25.50	-2.05	-2.01	-1.9p2	21.0	16.9	LN peak 2 (VS)
	12	24.60	24.58	25.55	-1.94	-1.99	-1.9p2	10.8	14.0	LN
1989	01	24.63	24.81	25.63	-1.91	-1.77	-1.7	13.2	11.6	LN
	02	25.39	25.34	25.71	-1.33	-1.44	-1.5	9.1	9.5	LN
	03	25.93	25.98	25.78	-1.20	-1.18	-1.1	6.7	10.9	LN
	04	26.66	26.58	25.89	-0.98	-0.95	-0.8	21.0	15.9	LN
	05	27.06	26.96	26.04	-0.63	-0.69	-0.6e	14.7	14.5	LN
	06	27.04	26.98	26.19	-0.52	-0.50	-0.4	7.4	9.7	LN end
	07	26.76	26.71	26.36	-0.31	-0.40	-0.3	9.4	5.0	
	08	26.29	26.43	26.51	-0.47	-0.38	-0.3	-6.3	0.6	
	09	26.37	26.34	26.65	-0.25	-0.32	-0.3	5.7	3.1	
	10	26.33	26.35	26.77	-0.30	-0.26	-0.3	7.3	4.6	
	11	26.36	26.38	26.87	-0.17	-0.17	-0.2	-2.0	-0.4	
	12	26.46	26.47	26.94	-0.02	-0.04	-0.1	-5.0	-3.3	
1990	01	26.60	26.70	27.00	0.06	0.13	0.1	-1.1	-6.1	
	02	27.12	27.08	27.05	0.40	0.30	0.2	-17.3	-11.1	
	03	27.46	27.52	27.11	0.33	0.36	0.2	-8.5	-8.7	
	04	28.03	27.93	27.15	0.39	0.40	0.2	-0.5	0.9	
	05	28.19	28.03	27.19	0.50	0.38	0.2	13.1	6.7	
	06	27.69	27.74	27.22	0.13	0.27	0.2	1.0	5.2	
	07	27.37	27.37	27.26	0.30	0.26	0.3	5.5	1.8	
	08	27.05	27.09	27.28	0.29	0.28	0.3	-5.0	-3.0	
	09	26.87	26.91	27.27	0.25	0.26	0.3	-7.6	-4.6	
	10	26.86	26.83	27.27	0.23	0.23	0.3	1.8	-2.3	
	11	26.73	26.81	27.27	0.20	0.25	0.3	-5.3	-2.8	
	12	26.90	26.91	27.30	0.36	0.37	0.4	-2.4	-1.3	

Table 7. SST monthly values of the Niño 3.4 region in degrees Celsius based on HadSST time series, ONI and SOI values, and the occurrences of EN (warm) and LN (cold) events from 1871 to the present (Continued).

Year	Mon	HadSST	2-mma	12-mma	D(m)	D(m <sup>2</sup> )	ONI	SOI*	SOI(2)	Comments**
1991	01	27.09	27.04	27.35	0.55	0.46	0.4	5.1	2.1	
	02	27.08	27.15	27.38	0.36	0.38	0.3	0.6	-1.1	
	03	27.36	27.45	27.39	0.23	0.29	0.3	-10.6	-8.4	
	04	27.98	27.91	27.43	0.34	0.38	0.4	-12.9	-13.9	
	05	28.30	28.23	27.51	0.61	0.59	0.6s	-19.3	-14.3	EN start
	06	28.34	28.20	27.60	0.78	0.79	0.8	-5.5	-8.0	EN peak 1 (W)
	07	27.84	27.83	27.70	0.77	0.72	1.0p1	-1.7	-4.1	EN
	08	27.30	27.36	27.80	0.54	0.55	0.9	-7.6	-8.4	EN
	09	26.98	27.23	27.92	0.36	0.57	0.9	-16.6	-13.4	EN
	10	27.64	27.51	28.03	1.01	0.91	1.0	-12.9	-12.4	EN
	11	27.79	27.86	28.11	1.26	1.30	1.4	-7.3	-11.1	EN
	12	28.20	28.10	28.14	1.66	1.56	1.6	-16.7	-16.5	EN
1992	01	28.19	28.24	28.12	1.65	1.66	1.8p2	-25.4	-19.2	EN peak 2 (S)
	02	28.39	28.43	28.08	1.67	1.66	1.6	-9.3	-17.1	EN peak 2 (S)
	03	28.76	28.77	28.04	1.63	1.62	1.5	-24.2	-19.1	EN
	04	29.18	28.81	27.98	1.54	1.54	1.4	-18.7	-15.3	EN
	05	29.13	28.92	27.87	1.44	1.27	1.2	0.5	-7.6	EN
	06	28.22	28.27	27.75	0.66	0.80	0.8	-12.8	-8.0	EN end
	07	27.50	27.49	27.63	0.43	0.37	0.5e	-6.9	-6.3	
	08	26.73	26.89	27.53	-0.03	0.09	0.2	1.4	-0.8	
	09	26.61	26.59	27.43	-0.01	-0.07	0.0	0.8	-3.6	
	10	26.39	26.48	27.37	-0.24	-0.13	-0.1	-17.2	-10.2	
	11	26.51	26.51	27.33	-0.02	-0.05	0.0	-7.3	-9.3	
	12	26.63	26.66	27.32	0.09	0.12	0.2	-5.5	-6.6	
1993	01	26.86	26.88	27.33	0.32	0.30	0.3	-8.2	-7.5	
	02	27.18	27.24	27.35	0.46	0.46	0.4	-7.9	-8.1	
	03	27.73	27.83	27.38	0.60	0.68	0.6	-8.5	-11.5	EN start
	04	28.68	28.47	27.42	1.04	0.95	0.7	-21.1	-14.7	EN
	05	28.79	28.65	27.47	1.10	1.00	0.8	-8.2	-13.4	EN peak (M)
	06	28.33	28.25	27.49	0.77	0.78	0.7	-16.0	-12.8	EN
	07	27.55	27.62	27.49	0.48	0.50	0.4	-10.8	-12.9	EN end
	08	27.04	27.16	27.45	0.28	0.36	0.4	-14.0	-11.6	
	09	27.01	27.04	27.41	0.39	0.38	0.4	-7.6	-10.7	
	10	27.09	27.03	27.35	0.46	0.43	0.4	-13.5	-8.5	
	11	26.94	26.94	27.28	0.41	0.38	0.3	0.6	-2.7	
	12	26.77	26.77	27.23	0.23	0.24	0.2	1.6	0.6	
1994	01	26.61	26.65	27.21	0.07	0.06	0.2	-1.6	-0.3	
	02	26.60	26.75	27.21	-0.12	-0.03	0.2	0.6	-2.8	
	03	27.19	27.20	27.24	0.06	0.04	0.3	-10.6	-10.9	
	04	27.80	27.70	27.26	0.16	0.17	0.4	-22.8	-17.3	
	05	28.00	27.94	27.32	0.31	0.30	0.5s	-13.0	-14.8	
	06	27.96	27.83	27.40	0.40	0.36	0.5	-10.4	-13.0	
	07	27.38	27.53	27.49	0.31	0.42	0.6	-18.0	-15.9	
	08	27.40	27.33	27.58	0.64	0.53	0.6	-17.2	-17.4	EN start
	09	27.15	27.33	27.64	0.53	0.68	0.7	-17.2	-16.4	EN
	10	27.63	27.55	27.68	1.00	0.95	0.9	-14.1	-13.2	EN
	11	27.79	27.75	27.68	1.26	1.20	1.2	-7.3	-10.1	EN
	12	27.80	27.77	27.67	1.26	1.23	1.3p	-11.6	-8.6	EN peak (M)

Table 7. SST monthly values of the Niño 3.4 region in degrees Celsius based on HadSST time series, ONI and SOI values, and the occurrences of EN (warm) and LN (cold) events from 1871 to the present (Continued).

Year	Mon	HadSST	2-mma	12-mma	D(m)	D(m <sup>2</sup> )	ONI	SOI*	SOI(2)	Comments**
1995	01	27.68	27.70	27.66	1.14	1.12	1.2	-4.0	-5.6	EN
	02	27.64	27.68	27.61	0.92	0.90	0.9	-2.7	-1.5	EN
	03	27.75	27.80	27.53	0.62	0.64	0.7e	3.5	-3.0	EN end
	04	28.04	27.93	27.43	0.40	0.41	0.4	-16.2	-9.5	
	05	27.89	27.90	27.28	0.20	0.25	0.3	-9.0	-8.9	
	06	27.77	27.67	27.12	0.21	0.20	0.2	-1.5	-2.0	
	07	27.26	27.45	26.96	0.19	0.08	0.0	4.2	1.9	
	08	26.50	26.61	26.83	-0.26	-0.19	-0.2	0.8	2.3	
	09	26.18	26.22	26.72	-0.44	-0.44	-0.5s	3.2	1.5	
	10	26.01	26.02	26.66	-0.62	-0.59	-0.6	-1.3	0.5	LN start
	11	25.87	25.90	26.61	-0.66	-0.66	-0.7p	1.3	-1.1	LN peak (W)
	12	25.86	25.88	26.59	-0.68	-0.66	-0.7p	-5.5	-0.3	LN peak (W)
1996	01	25.93	25.96	26.57	-0.61	-0.63	-0.7p	8.4	3.1	LN
	02	26.10	26.23	26.57	-0.62	-0.55	-0.7p	1.1	4.2	LN end
	03	26.78	26.77	26.58	-0.35	-0.38	-0.5e	6.2	5.3	
	04	27.43	27.28	26.61	-0.21	-0.25	-0.3	7.8	5.8	
	05	27.46	27.48	26.65	-0.23	-0.17	-0.1	1.3	6.1	
	06	27.57	27.42	26.68	0.01	-0.05	-0.1	13.9	9.0	
	07	27.08	27.08	26.70	0.01	-0.04	0.0	6.8	8.0	
	08	26.58	26.66	26.73	-0.18	-0.14	-0.1	4.6	5.7	
	09	26.41	26.47	26.76	-0.21	-0.19	-0.1	6.9	5.7	
	10	26.46	26.42	26.81	-0.17	-0.18	-0.2	4.2	3.8	
	11	26.35	26.33	26.89	-0.18	-0.20	-0.3	-0.1	2.8	
	12	26.16	26.21	27.00	-0.28	-0.28	-0.4	7.2	4.6	
1997	01	26.15	26.25	27.12	-0.39	-0.31	-0.4	4.1	7.2	
	02	26.53	26.60	27.29	-0.19	-0.18	-0.3	13.3	5.6	
	03	27.19	27.26	27.48	0.06	0.10	0.0	-8.5	-5.0	
	04	28.11	28.04	27.69	0.47	0.51	0.4	-16.2	-15.8	EN start
	05	28.74	28.61	27.91	1.05	0.96	0.8s	-22.4	-21.3	EN
	06	28.84	28.81	28.14	1.28	1.34	1.3	-24.1	-20.0	EN
	07	28.83	28.83	28.37	1.76	1.71	1.7	-9.5	-15.7	EN
	08	28.81	28.83	28.59	2.05	2.02	2.0	-19.8	-16.0	EN
	09	28.85	28.88	28.75	2.23	2.23	2.2	-14.8	-16.8	EN
	10	29.02	28.99	28.84	2.39	2.39	2.4	-17.8	-16.4	EN
	11	29.08	29.02	28.85	2.55	2.46	2.5p	-15.2	-14.3	EN peak (VS)
	12	28.89	28.97	28.78	2.35	2.43	2.5p	-9.1	-14.2	EN
1998	01	29.00	28.93	28.62	2.46	2.35	2.3	-23.5	-18.8	EN
	02	28.84	28.86	28.41	2.12	2.07	1.9	-19.2	-22.6	EN
	03	28.75	28.75	28.17	1.62	1.60	1.5	-28.5	-25.2	EN
	04	28.67	28.66	27.90	1.03	1.14	1.0	-24.4	-19.2	EN
	05	28.55	28.27	27.60	0.86	0.62	0.5e	0.5	-3.4	EN end
	06	27.30	27.41	27.29	-0.26	-0.06	0.0	9.9	8.7	
	07	26.49	26.58	26.97	-0.58	-0.54	-0.5s	14.6	12.2	LN start
	08	26.04	26.13	26.66	-0.72	-0.68	-0.8	9.8	11.3	LN
	09	25.93	25.86	26.41	-0.69	-0.80	-1.0	11.1	10.7	LN
	10	25.54	25.61	26.24	-1.09	-0.99	-1.1	10.9	11.4	LN
	11	25.43	25.37	26.11	-1.10	-1.19	-1.3	12.5	12.3	LN
	12	25.08	25.16	26.02	-1.46	-1.38	-1.4p1	13.3	13.7	LN



Table 7. SST monthly values of the Niño 3.4 region in degrees Celsius based on HadSST time series, ONI and SOI values, and the occurrences of EN (warm) and LN (cold) events from 1871 to the present (Continued).

Year	Mon	HadSST	2-mma	12-mma	D(m)	D(m <sup>2</sup> )	ONI	SOI*	SOI(2)	Comments**
1999	01	25.05	25.13	25.99	-1.49	-1.45	-1.4p1	15.6	13.3	LN peak 1 (M)
	02	25.35	25.52	25.98	-1.37	-1.26	-1.2	8.6	9.9	LN
	03	26.34	26.25	25.97	-0.79	-0.91	-0.9	8.9	11.2	LN
	04	26.96	26.81	25.98	-0.68	-0.71	-0.8	18.5	11.8	LN
	05	26.99	26.92	25.98	-0.70	-0.73	-0.8	1.3	5.5	LN
	06	26.74	26.72	25.97	-0.82	-0.76	-0.8	1.0	2.0	LN
	07	26.39	26.35	25.96	-0.68	-0.76	-0.9	4.8	3.2	LN
	08	25.89	26.02	25.94	-0.87	-0.78	-0.9	2.1	2.2	LN
	09	25.91	25.85	25.92	-0.71	-0.81	-1.0	-0.4	2.6	LN
	10	25.70	25.64	25.91	-0.93	-0.97	-1.1	9.1	7.7	LN
	11	25.24	25.31	25.91	-1.29	-1.25	-1.3	13.1	12.0	LN
	12	25.04	25.03	25.92	-1.50	-1.51	-1.6p2	12.8	11.0	LN
2000	01	24.79	24.96	25.94	-1.75	-1.62	-1.6p2	5.1	9.0	LN peak 2 (S)
	02	25.23	25.31	25.98	-1.49	-1.47	-1.4	12.9	10.1	LN
	03	26.00	26.05	26.02	-1.13	-1.11	-1.0	9.4	12.1	LN
	04	26.97	26.75	26.06	-0.67	-0.77	-0.8	16.8	11.7	LN
	05	27.07	27.01	26.11	-0.62	-0.64	-0.6	3.6	4.6	LN
	06	26.93	26.90	26.16	-0.63	-0.58	-0.5e	-5.5	-2.8	LN end
	07	26.65	26.69	26.23	-0.42	-0.43	-0.4	-3.7	-1.9	
	08	26.52	26.51	26.30	-0.24	-0.29	-0.4	5.3	4.2	
	09	26.36	26.36	26.37	-0.26	-0.30	-0.4	9.9	8.7	
	10	26.18	26.16	26.43	-0.45	-0.45	-0.5s	9.7	12.9	
	11	25.91	25.92	26.47	-0.62	-0.64	-0.6	22.4	15.6	
	12	25.67	25.74	26.52	-0.87	-0.80	-0.7p	7.7	11.7	
2001	01	25.70	25.80	26.57	-0.84	-0.79	-0.6	8.9	9.4	
	02	26.13	26.19	26.60	-0.59	-0.59	-0.5e	11.9	9.9	
	03	26.78	26.79	26.62	-0.35	-0.37	-0.4	6.7	6.4	
	04	27.47	27.32	26.64	-0.17	-0.20	-0.2	0.3	-0.4	
	05	27.57	27.55	26.67	-0.12	-0.10	-0.1	-9.0	-4.0	
	06	27.58	27.49	26.71	0.02	0.02	0.1	1.8	-2.1	
	07	27.24	27.22	26.76	0.17	0.10	0.2	-3.0	-3.3	
	08	26.80	26.83	26.81	0.04	0.03	0.2	-8.9	-4.9	
	09	26.47	26.55	26.86	-0.15	-0.11	0.1	1.4	-2.0	
	10	26.47	26.45	26.91	-0.16	-0.16	0.0	-1.9	1.2	
	11	26.37	26.34	26.95	-0.16	-0.22	-0.1	7.2	0.9	
	12	26.13	26.27	27.00	-0.41	-0.27	-0.1	-9.1	-2.1	
2002	01	26.44	26.44	27.06	-0.10	-0.14	-0.1	2.7	1.0	
	02	26.76	26.83	27.11	0.04	0.05	0.1	7.7	3.2	
	03	27.36	27.35	27.19	0.23	0.19	0.2	-5.2	-1.6	
	04	27.91	27.81	27.29	0.27	0.29	0.4	-3.8	-6.8	
	05	28.07	28.11	27.42	0.38	0.46	0.7s	-14.5	-9.8	
	06	28.37	28.15	27.57	0.81	0.68	0.8	-6.3	-8.7	EN start
	07	27.80	27.89	27.70	0.73	0.77	0.9	-7.6	-9.0	EN
	08	27.57	27.63	27.77	0.81	0.83	1.0	-14.6	-11.1	EN
	09	27.57	27.65	27.81	0.95	0.99	1.1	-7.6	-9.3	EN
	10	27.89	27.85	27.82	1.26	1.25	1.3	-7.4	-7.1	EN
	11	28.06	28.00	27.78	1.53	1.45	1.5p	-6.0	-7.5	EN peak (M)
	12	28.00	27.91	27.72	1.46	1.34	1.4	-10.6	-7.3	EN



Table 7. SST monthly values of the Niño 3.4 region in degrees Celsius based on HadSST time series, ONI and SOI values, and the occurrences of EN (warm) and LN (cold) events from 1871 to the present (Continued).

Year	Mon	HadSST	2-mma	12-mma	D(m)	D(m <sup>2</sup> )	ONI	SOI*	SOI(2)	Comments**
2003	01	27.56	27.63	27.66	1.02	1.05	1.2	-2.0	-5.5	EN
	02	27.40	27.53	27.62	0.68	0.75	0.9	-7.4	-5.9	EN
	03	27.74	27.66	27.56	0.61	0.50	0.5e	-6.8	-6.6	EN end
	04	27.74	27.64	27.51	0.10	0.12	0.1	-5.5	-6.3	
	05	27.34	27.48	27.43	-0.35	-0.17	-0.1	-7.4	-8.1	
	06	27.50	27.43	27.35	-0.06	-0.04	0.1	-12.0	-7.1	
	07	27.37	27.29	27.27	0.30	0.18	0.4	2.9	-2.0	
	08	26.92	27.03	27.22	0.16	0.23	0.5	-1.8	-0.7	
	09	26.90	26.98	27.18	0.28	0.32	0.6	-2.2	-2.0	
	10	27.19	27.08	27.16	0.56	0.48	0.5	-1.9	-2.4	
	11	27.05	27.05	27.19	0.52	0.49	0.6	-3.4	0.3	
	12	26.91	26.93	27.23	0.37	0.39	0.4	9.8	1.2	
2004	01	26.84	26.88	27.25	0.30	0.30	0.4	-11.6	-1.2	
	02	26.93	26.97	27.29	0.21	0.19	0.3	8.6	1.5	
	03	27.16	27.27	27.34	0.03	0.12	0.2	0.2	-1.6	
	04	27.83	27.70	27.37	0.19	0.17	0.2	-15.4	-4.4	
	05	27.96	27.89	27.39	0.27	0.25	0.3	13.1	-0.9	
	06	27.82	27.81	27.41	0.26	0.34	0.5s	-14.4	-5.7	
	07	27.64	27.66	27.44	0.57	0.55	0.7	-6.9	-9.0	EN start
	08	27.54	27.54	27.46	0.78	0.53	0.8	-7.6	-6.2	EN
	09	27.42	27.46	27.48	0.80	0.80	0.9p	-2.8	-4.2	EN peak (W)
	10	27.46	27.40	27.50	0.83	0.80	0.8	-3.7	-4.9	EN peak (W)
	11	27.27	27.33	27.52	0.74	0.77	0.8	-9.3	-7.6	EN
	12	27.30	27.25	27.53	0.76	0.72	0.8	-8.0	-5.9	EN
2005	01	27.14	27.15	27.52	0.60	0.57	0.7	1.8	-8.4	EN end
	02	27.02	27.18	27.47	0.30	0.40	0.5e	-29.1	-14.1	
	03	27.54	27.54	27.41	0.41	0.38	0.4	0.2	-10.0	
	04	28.05	27.95	27.34	0.41	0.43	0.4	-11.2	-9.2	
	05	28.16	28.07	27.26	0.47	0.43	0.4	-14.5	-9.4	
	06	27.91	27.80	27.16	0.35	0.33	0.4	2.6	-2.1	
	07	27.22	27.30	27.03	0.15	0.18	0.4	0.9	-0.6	
	08	26.83	26.89	26.93	0.07	0.09	0.3	-6.9	-2.3	
	09	26.67	26.69	26.85	0.05	0.03	0.2	3.9	3.0	
	10	26.59	26.52	26.78	-0.04	-0.09	-0.1	10.9	5.8	
	11	26.21	26.21	26.74	-0.32	-0.35	-0.4	-2.7	1.5	
	12	25.83	25.87	26.72	-0.71	-0.67	-0.7	0.6	2.8	
2006	01	25.60	25.77	26.71	-0.94	-0.82	-0.7	12.7	6.5	
	02	26.05	26.06	26.73	-0.67	-0.72	-0.6	0.1	6.7	
	03	26.53	26.65	26.78	-0.60	-0.51	-0.4	13.8	10.7	
	04	27.47	27.31	26.85	-0.17	-0.22	-0.1	15.2	8.6	
	05	27.76	27.69	26.94	0.07	0.05	0.1	-9.8	-2.5	
	06	27.78	27.64	27.08	0.22	0.17	0.2	-5.5	-7.4	
	07	27.25	27.38	27.22	0.18	0.27	0.3	-8.9	-9.8	
	08	27.25	27.28	27.32	0.49	0.48	0.5s	-15.9	-11.5	
	09	27.38	27.38	27.38	0.76	0.72	0.6	-5.1	-10.4	EN start
	10	27.49	27.50	27.41	0.86	0.90	0.9	-15.3	-9.3	EN
	11	27.64	27.62	27.41	1.11	1.06	1.1p	-1.4	-5.3	EN peak (M)
	12	27.69	27.55	27.38	1.15	1.01	1.1p	-3.0	-3.7	EN

Table 7. SST monthly values of the Niño 3.4 region in degrees Celsius based on HadSST time series, ONI and SOI values, and the occurrences of EN (warm) and LN (cold) events from 1871 to the present (Continued).

Year	Mon	HadSST	2-mma	12-mma	D(m)	D(m <sup>2</sup> )	ONI	SOI*	SOI(2)	Comments**
2007	01	27.17	26.98	27.36	0.63	0.64	0.8e	-7.3	-5.1	EN end
	02	26.88	27.01	27.30	0.16	0.23	0.4	-2.7	-3.5	
	03	27.11	27.18	27.19	-0.02	0.02	0.1	-1.4	-2.1	
	04	27.61	27.45	27.03	-0.03	-0.08	-0.1	-3.0	-2.5	
	05	27.47	27.52	26.83	-0.22	-0.13	-0.1	-2.7	-0.9	
	06	27.52	27.34	26.61	-0.04	-0.13	-0.1	5.0	0.8	
	07	26.86	26.89	26.40	-0.21	-0.23	-0.1	-4.3	-0.2	
	08	26.31	26.30	26.23	-0.45	-0.51	-0.4	2.7	0.7	LN start
	09	25.71	25.77	26.11	-0.91	-0.89	-0.7s	1.5	2.8	LN
	10	25.33	25.36	26.04	-1.30	-1.24	-1.0	5.4	5.5	LN
	11	25.07	25.11	26.00	-1.46	-1.45	-1.1	9.8	9.9	LN
	12	24.98	24.96	25.97	-1.56	-1.58	-1.3	14.4	13.2	LN
2008	01	24.79	24.91	25.98	-1.75	-1.68	-1.4p	14.1	16.0	LN peak (S)
	02	25.07	25.26	26.01	-1.65	-1.52	-1.4p	21.3	17.2	LN
	03	26.09	26.03	26.07	-1.04	-1.12	-1.1	12.2	12.6	LN
	04	26.88	26.77	26.14	-0.76	-0.76	-0.8	4.5	4.2	LN
	05	27.22	27.14	26.24	-0.47	-0.51	-0.6e	-4.3	0.2	LN end
	06	27.24	27.22	26.32	-0.32	-0.25	-0.4	5.0	2.0	
	07	27.19	27.11	26.38	0.12	0.00	-0.1	2.2	4.6	
	08	26.83	26.83	26.46	0.07	0.03	0.0	9.1	8.6	
	09	26.47	26.55	26.52	-0.15	-0.11	0.0	14.1	12.7	
	10	26.43	26.41	26.56	-0.20	-0.20	0.0	13.4	14.5	
	11	26.29	26.18	-	-0.24	-0.38	-0.3	17.1	15.2	
	12	25.69	25.81	-	-0.85	-0.73	-0.6	13.3	13.3	
2009	01	25.58	25.73	-	-0.96	-0.86	-0.8	9.4	11.7	
	02	26.05	26.06	-	-0.67	-0.72	-0.7	14.8	9.8	
	03	26.54	26.66	-	-0.59	-0.49	-0.5	0.2	6.0	
	04	27.52	-	-	-0.12	-	-0.1	8.6	3.1	
	05	-	-	-	-	-	0.2	-5.1	-1.0	
	06	-	-	-	-	-	0.6s	-2.3	-2.0	
	07	-	-	-	-	-	0.7	1.6	-1.0	
	08	-	-	-	-	-	0.8	-5.0	-1.1	
	09	-	-	-	-	-	0.9	3.9	-3.0	
	10	-	-	-	-	-	1.2	-14.7	-8.1	
	11	-	-	-	-	-	1.5	-6.7	-8.8	
	12	-	-	-	-	-	1.8p	-7.0	-7.7	
2010	01	-	-	-	-	-	1.7	-10.1	-10.4	
	02	-	-	-	-	-	-	-14.5	-	

Notes: HadSST = monthly values of the average temperature of the Niño 3.4 region, available at <[http://www.cdc.noaa.gov/gcos\\_wgsp/Timeseries/Data/nino34\\_long.data](http://www.cdc.noaa.gov/gcos_wgsp/Timeseries/Data/nino34_long.data)>.

$M$  = mean (1871–2008),  $M$  = 26.95.

$sd$  = standard deviation (1871–2008),  $sd$  = 0.87.

$CV$  = coefficient of variation (1871–2008),  $CV = sd/M = 0.032$ .

$m$  = median (1871–2008),  $m$  = 26.96.

$PCS$  = Pearson Coefficient of Skewness (1871–2008),  $PCS = 3(M-m)/sd = -0.034$ .

$na$  = number of monthly values above median (1871–2008),  $na$  = 828.

$nb$  = number of monthly values below median (1871–2008),  $nb$  = 828.

$nra$  = number of runs above median (1871–2008),  $nra$  = 120.

$z$  = the normal deviate of the monthly values (1871–2008),  $z = -28.94$ , a value indicating that the distribution of HadSST is highly nonrandom.

Table 7. SST monthly values of the Niño 3.4 region in degrees Celsius based on HadSST time series, ONI and SOI values, and the occurrences of EN (warm) and LN (cold) events from 1871 to the present (Continued).

2-mma = 2-month moving average.

12-mma = 12-month moving average.

D(m) = difference between HadSST and the monthly-adjusted average (1871–2008).

D(m2) = 2-mma of D(m).

ONI = Oceanic Niño Index based on ERSST.v3b, available at <[http://www.cpc.noaa.gov/products/analysis\\_monitoring/ensostuff/ensoyears.shtml](http://www.cpc.noaa.gov/products/analysis_monitoring/ensostuff/ensoyears.shtml)>.

\* means SOI monthly values for 1871–1875 were taken from <[http://www.cdc.noaa.gov/gcos\\_wgsp/Timeseries/Data/soi.long.data](http://www.cdc.noaa.gov/gcos_wgsp/Timeseries/Data/soi.long.data)> and multiplied by 10; values from 1876–present were taken from <<http://www.bom.gov.au/climate/current/soihtml.shtml>>.

\*\* means EN/LN determination based on D(m2).

EN means El Niño.

LN means La Niña.

M in comments column means moderate strength.

S means strong strength.

VS means very strong strength.

W means weak strength.

b means event start before, using ONI.

e means event end, using ONI.

p means event peak, using ONI.

s means event start, using ONI.

Monthly-adjusted averages of HadSST:

1871–2008	
January	26.54
February	26.72
March	27.13
April	27.64
May	27.69
June	27.56
July	27.07
August	26.76
September	26.62
October	26.63
November	26.53
December	26.54



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